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Palmette trees in an Italian orchard

Apple and Pear Production in Europe

F. A. Roach

In the early post-war years supplies in Europe of fresh fruits, as of other foods, were in short supply, prices were high and, since apples and pears sold readily, comparatively little attention was at first given to their quality. As a result of the shortage in Europe and the limitation in the supplies sent from North America, considerable planting of apples and pears took place in Italy which quickly became the main European exporter of these fruits both to Britain and other countries of Europe.

As the period of shortages and high prices passed, greater attention was paid to quality and to the planting of new orchards of varieties more acceptable for dessert. Throughout Europe much grubbing of old orchards has been done and in place of the large trees, often grown in farm orchards, many new apple and pear orchards consist of relatively intensively planted trees.

The extension in planting in Italy was followed by a spectacular increase in the production of apples in France especially during recent years, but unlike Italy where apple production has tended to level out, apple production in France continues to rise. During the last three years total apple production in Italy has averaged rather more than 1,900,000 metric tonnes and that of France 1,726,000. Pear production in Italy in the same period averaged 1,390,000 metric tonnes and in France 405,000. In comparison production of dessert apples in the last three years, including two years of relatively light crops, in Britain has averaged 215,000 metric tonnes and of pears 52,000.

Modern orchard of Golden Delicious spindlebushes at Kraggenburg, North Polder, Holland

In addition, Britiain produces 150,000—250,000 metric tonnes of cooking apples. In a year of full crop total apple production might be up to 600,000 metric tonnes.

Holland is a country which has modernized its production of apples and pears by the extensive grubbing of old orchards and replacing them mainly with intensively planted spindlebushes. As it is grown in Holland, the apple spindlebush is usually worked on a dwarfing rootstock and the central stem is trained to a tall stake. This form of tree is also popular on various types of rootstocks for apple production in other countries of Northern Europe including Germany but in Italy, the South of France and the Balkans, the palmette, trained in a vertical plane like an espalier, is generally used. Regardless of the particular type of system used nearly all have one feature in common, in that the trees are planted more closely in the rows than between, forming hedge-like rows. The small spindlebush trees in Holland grown on dwarfing rootstocks can be readily picked and pruned from the ground but for the taller palmettes various types of picking platforms are used.

Modernization of orchards and the extension in planting has also taken place in other countries of Europe including Belgium and West Germany, the latter being regarded pre-war as the main customer for exports from the U.S.A. and since the war for fruit from Italy, France and Holland. Production of apples and pears is also increasing in Spain.

At the same time production of these fruits has been expanding in western Europe, especially during the past ten years; there has also been a considerable effort to improve the standard of production and increase output of apples and pears in Eastern Europe.

Improvements in production and the planting of new orchards in these countries after the war was not so rapid as in countries of the west. This meant that there was, and still is to some extent, a shortage of fresh fruits in a number of east European countries. Production is, however, increasing at a fast rate and already exports from several countries are becoming important. Hungary in particular has increased her apple production to a considerable extent mainly in response to the demand from other countries of the eastern

area although some Hungarian apples are marketed in the west, especially in West Germany. She is today the leading apple producer in Eastern Europe. Bulgaria, Rumania and Yugoslavia are all becoming of increasing importance as fruit producers but Czechoslovakia and East Germany, with a greater degree of industrialization rely rather more on fruit imports.

Position in the E.E.C.

The results of the extensive planting, especially of apples, in the E.E.C. countries, has resulted in considerable over-production. In most years production is greater than can be absorbed by the markets and up to 40 per cent of the Italian apple crop is made into industrial alcohol while large tonnages of apples in France and Holland are bought up for destruction. Even these steps have failed to prevent growers returns for apples, and in some years for pears, falling to uneconomic levels.

One of the major problems is the over production of the apple Golden Delicious. This apple is relatively easy to grow and crops heavily even in young orchards. In France, where a few years ago Golden Delicious sold well, it now forms over half of the total apple production averaging one million tonnes during 1968-69, and market returns have considerably declined.

In Italy production of Golden Delicious exceeds 300,000 metric tonnes and even in Holland production in 1969 was 130,000 metric tonnes. As a result of the poor state of the apple market, the Dutch Government was the first to introduce grants for the grubbing of orchards. These will be superseded by the recent agreement between all members of the E.E.C. to pay grants, the cost of which will be equally shared between the Member State and the Community's Agricultural Member Fund, towards the cost of grubbing apple, pear and peach trees in orchards and roadside plantings. The beneficiaries of the grants may not make fresh plantings of these fruits on their holdings for five years.

Over-production of pears is also a problem in the E.E.C. In the production and export of pears Italy leads the world. Her exports represent about 40 per cent of the world trade in pears. Italy's predominence in early pears and, more recently, in the production of the late keeping Passe Crassane, has led to difficulties for other countries and in 1968 the Dutch withdrew from their markets 60,000 metric tonnes of pears, equal to Britain's total production of Conference in that year.

At present the importation into Britain of apples and pears from non-sterling countries is subject to control by quota so that the impact of over-production in Europe has not yet been felt. Golden Delicious apples purchased cheaply on the Continent sell for high prices over here; a matter of supply and demand on our markets dominated by Cox's Orange Pippin. It is of interest to note that during the autumn and early months of the present winter market returns for Golden Delicious in Holland have averaged only half those for Cox's Orange Pippin, in spite of the fact that the Dutch crop of the latter was the greatest yet produced, 75,000 metric tonnes compared with a British production of 140,000 metric tonnes.

The future

Present or impending over-production of both apples and pears is of particular concern to the O.E.C.D. and reports on the position in member

nations of both these crops have been published together with some suggestions as to meeting the problem. These suggestions include the stopping of all measures aiming to encourage production; grants for the grubbing of old orchards and varieties in declining demand and, in some cases, comparatively new orchards of varieties which have been overplanted in recent years; and the use of publicity to increase sales. Most of the measures suggested are already in existence in Britain under the Ministry of Agriculture's Horticultural Improvement Schemes and publicity is handled by the Apple and Pear Development Council.

Whatever happens it is probable that the difficulties of over-production in Europe will continue for some years. Even when growers go bankrupt or sell out, their orchards often remain in production.

It is likely that apple and pear production in Europe will continue to be dominated by France and Italy. The French with their increasing production of apples, with a potential yield of up to 1½ million metric tonnes of Golden Delicious, will lead in this field but Italian growers are doing much to replace some of their large production of poorer quality apples, such as Abbondanza, by more acceptable dessert varieties.

Italy with her favourable climate for pears is likely to maintain her position as the world's largest producer and exporter of this fruit.

While France and Italy are likely to continue and to extend their domination of the apple and pear market in Europe, especially in countries of the Common Market, the improvement and increase in production in other countries of the Northern Hemisphere are bound to have their effect.

The increase in production in northern Spain could well rival some of the early season pears and apples from Italy and southern France.

At present West Germany is the main market for apples exported from Italy and to a lesser extent from France and Holland. While it will be some time before Germany has sufficient good quality production of her own to satisfy her major requirements for apples there is already increasing production of apples as in the Lake Constance region.

The need on the part of Italy and France to increase their exports will also increase the economic problems of growers in Holland, Belgium and Scandinavia. Growers in Holland, even with their efficiency in production and marketing, are already finding competition is making it difficult to maintain their position in a world of increasing costs and low prices.

Apart from increased apple production in western Europe, the considerable extension in certain east European states is important. At present East Germany, Czechoslovakia and the U.S.S.R. have insufficient production for home needs and it is likely that the former two mainly industrialized countries will continue to rely on imports. Such imports are likely to come from other east European countries such as Hungary and Bulgaria rather than western Europe. The case of the U.S.S.R. is interesting in that while she at present lacks sufficient production to meet her own needs, the enormous newly-developed orchards of the Ukraine and Moldavia could eventually provide sufficient fruit for all her own requirements and even allow for exports. Such a position, however, is unlikely to arise for some years.

The author of this article, **F. A. Roach, B.Sc.(Hort.)**, who has been with the N.A.A.S. since its inception in 1946, is National Fruit Adviser at East Malling Research Station. He has travelled extensively, visiting fruit production areas and research stations in many parts of Europe, including the U.S.S.R. and Poland.

L. F. Myall, N.D.A., a District Agricultural Adviser for the N.A.A.S. in Carmarthen, gives an example of how, on a suitable hill farm with good management, intensification is possible.

A Carmarthen Hill Farm

HILL farming is generally thought of as being an extensive system, but at Banc Farm, Abergorlech, Carmarthenshire, this idea is totally rejected.

Resources and planning

Banc Farm is in a typical livestock rearing area, being bordered by forest on two-thirds of its boundary. It extends to 360 acres, of which 120 acres are one side of a steep, wooded and scrub-covered valley (known locally as a 'dingle'). The remaining 240 acres is clean, dry land, most of which is relatively flat, easily workable with modern machinery, and lying at 1,000 ft above sea level. The whole farm can be assessed as 270 adjusted acres. The soil is a Devonian shale, and the rainfall is between 60 and 70 in. annually. The entire farm falls within the area eligible for hill cow subsidy.

Mr. and Mrs. M. Harmer came to the farm in 1966, after having worked with Mrs. Harmer's father on the home farm in Surrey. At that time the buildings were very limited in number and scope, consisting of a small barn and range of loose boxes of traditional stone construction; there was also a relatively new general-purpose building measuring 60 by 75 ft built of reinforced concrete with an asbestos roof. There were very few stock-proof fences on the farm and, in the main, the fields were large.

Here then was a farm on which one of several very different systems could be practised. Which of these was likely to be the most practical and profitable? In fact, four possibilities were seriously considered:

1. large-scale dairying;
2. intensive cereal growing;
3. a combination of one and two;
4. an all grass system carrying a beef herd producing single-suckled calves and hill sheep.

These four possibilities were costed in detail, taking into account the relevant physical and management factors, such as altitude, rainfall, availability of labour and local market preferences. It was decided to adopt system four, but to cover a rent charge of £2,000 per annum, provide a return for Mr. and Mrs. Harmer's physical work, and show a return of at least 15 per cent on tenants capital there was no room for extensive farming. The hill farming system had to be intensified to the same extent as is possible in a dairying enterprise. The initial target was to be 75 Friesian × Hereford suckler cows and 750 Welsh ewes. This has now been increased to 100 sucklers and 1,000 ewes. A Hereford bull would be used on the suckler cows to produce colour-marked calves for the local autumn calf sales. A Charolais bull was, and still is, preferred for crossing because of its good liveweight gain potential, but the present scarcity and high price of such a bull precludes it from this system. Suffolk and Welsh rams would be used on Welsh ewes to produce fat lambs for sale and replacements to maintain a self-contained flock.

Various factors, notably inadequate buildings, lack of fencing and shortage of working capital, made it necessary for a gradual transition towards the ultimate plan. There was also the fact that in Surrey there were 120 autumn-calving dairy cows which produced 80–90 calves per annum in excess of those needed for dairy replacements. Most of these calves were, at that time, the progeny of a Hereford bull. It was decided to continue using the Hereford bull on about 70 of the dairy cows each year, the calves to come to Banc Farm at 4–6 months of age. The heifers would provide the suckler herd in due course, and the best of the steers would be fattened at about 18 months, the remainder being sold as stores. During this transitional period, as much barley as possible would be grown. A limited number of ewes would be purchased to form the basis of the flock.

Development

In the autumn of 1966, 350 Welsh ewes were purchased, a proportion of which were in-lamb. During that winter, Mr. Harmer erected about two miles of sheep fencing as he realized that good fencing was essential if a high stocking intensity was to be achieved. During the past three years the following stock numbers, cropping and output have developed:

	1966/67	1967/68	1968/69
Cattle under 1 year	60	40	20
1—2 years	10	30	20
over 2 years	—	—	30
Sales	—	40	50
Ewes (including ewe lambs)	350	700	886
Lambs sold	250	400	250 (to date)
Av. carcase weight (lb)	28	30	28
Ewe losses (%)	under 5	under 5	3½
Ewe lambs retained	100	186	250
Barley—acres	60	50	40
Yield per acre (cwt)	28	28	25

What of the present and future policy?

Grassland management

The farm is divided into thirteen blocks, of which one is the 120 acres of rough 'dingle'. The remaining 240 acres is fenced off into twelve areas, averaging 20 acres each. Approximately 90 acres have been reseeded during the past three years, to both short-term leys and permanent mixtures. All fields have received ten hundredweights per acre of basic slag since 1966 and it is planned to apply a similar dressing of potassic slag every three years as a routine dressing. Ground limestone has been applied as indicated by soil analysis.

Annual fertilizer treatment on the grazing area has consisted of 70 units of nitrogen per acre in late March to early April, followed by about 35 units after each grazing up to the end of September, the total annual dressing amounting to approximately 140 units. Topping, as necessary, is carried out with a forage harvester, usually twice during the season. All the cattle and sheep are grazed together, and remain on one block for about five days on average before being moved to the next block, the time varying in practice from two to eight days depending on the amount of grass available. The stock graze five or six blocks, amounting to about 120 acres, until after silage making, when the aftermaths are brought into the system, which coincides with the normal reduction in grass growth. After the corn harvest, the lambs are weaned and, to date, have been fattened on the stubbles, of which some have been whole cereal silage crops undersown. As the acreage of cereals declines, it will probably be necessary to sow some rape for this purpose.

Conservation consists almost entirely of silage, which receives a dressing of 70 units of nitrogen in spring. A very small amount of hay is made. The farmyard manure is applied to the cereal acreage.

Sheep management

This has been the main enterprise as the cattle have been built up. It has consisted mainly of old ewes while the flock has been expanded, but they have averaged almost 100 per cent true lambing percentage (per cent lambs sold of ewes put to the ram). The sheep are wintered in the 120 acres of 'dingle' and feeding begins about mid-January, consisting of some silage, a little hay to those ewes which will not eat silage, and access to a block containing urea, of which the ewes have eaten 1–1½ oz per head daily during the past two winters. Feeding continues until there is grass available, although a change to all hay feeding is made just before lambing. An alternative winter regime being considered is to rent 500 acres of adjoining forest from the Forestry Commission.

Lambing date has varied from March to mid-April in 1967 when it was not possible to exercise much control, mid-March in 1968 and early April this year. Later lambing was adopted to try and overcome the problem of feeding ewes with young lambs, which can become extremely difficult with a large flock and lead to mis-mothering. Obviously lambing cannot be much later than early April if all the lambs are to be finished and this must be the aim. There have been very few veterinary problems, although ten ewes were lost with hypomagnaesemia in 1968; but since then a high magnesium mineral has been fed in spring as a routine measure.

Cattle management

The enterprise has been developing steadily since spring 1967. Mixed grazing with sheep on a rotational system has always been practised without any difficulties, apart from an attack of husk in the autumn of 1967. The effect of this was to abandon the original plan to finish most of the steers in spring 1968. In fact the majority were sold as stores. Forty steers were sold in 1968 and 1969 together with the first suckled calves of 1969—ten in all averaging £44 per head. This winter the beef herd will consist of thirty cows and twenty in-calf heifers; from now on only heifer calves will be brought to Banc. The herd should total sixty in 1970 and the following year the target figure should be reached. The aim is to calve before Christmas. The cows will be brought indoors as they calve to be housed in cubicles in the original 75 x 60 ft building, and graze self-feed silage in a new 60 x 60 ft silo erected this year. The building will hold 100 suckler cows and allow room for several calving boxes.

The future

Stocking rate is a fair assessment of intensity of farming, especially when an allowance is made for purchased roughage. For the last three years the stocking rate (adjusted acres per livestock unit) for this farm has been:

1966/67	over three acres per livestock unit
1967/68	two acres per livestock unit
1968/69	1·6 acres per livestock unit

The planned stocking is now 100 cows and 1,000 breeding ewes. This will give a stocking rate of 1·3 acres per livestock unit on a farm 1,000 ft above sea level. Experience over the past three years shows no reason why this should not be achieved. Mr. and Mrs. Harmer are confident that with the use of adequate fertilizer, sufficient grass can be grown to maintain this high stocking rate.

The main problem is likely to be one of parasite and disease control, especially in the sheep flock. Worming will not be carried out as a routine measure, but only as indicated by faeces samples and in consultation with a veterinary surgeon. It is planned that the main control will be exercised by good grazing management in two ways. Firstly, due to the rotational grazing system, each area will be rested for three-four weeks between grazings. Secondly, the grassland will be divided into conservation and grazing blocks which will themselves be rotated annually so that the land will have a complete rest from grazing every third year.

To date, the financial return has reached the point where it has covered the rent charge, provided a fair return for Mr. and Mr. Harmer's labour, but as yet shows little interest on tenants capital. The increase in the suckler-herd should cover this factor adequately. It seems clear that on a suitable hill farm with good management, intensification is possible and a profitable farm system can be devised.

Prices of Agricultural Land

Details by 21 Valuation Office regions about prices paid between April, 1959, and April, 1969, are contained in Agricultural Land Service Technical Report No. 20, Agricultural Land Prices in England and Wales, copies of which can be obtained, free, from the Ministry's Publications Branch, Tolcarne Drive, Pinner, Middlesex HA5 2DT, or from any of the Ministry's Divisional Offices.

Provided the necessary resources are made available, rat control need be no less effective than it was before warfarin came into general use. The author, **J. H. Greaves** of the Infestation Control Laboratory, discusses the problems of

Warfarin-resistant Rats

THE resistance of man's enemies to the chemical compounds used to control them is a well-known phenomenon. Pathogenic bacteria have become resistant to antibiotics; insect pests of agriculture and disease vectors have become resistant to new synthetic insecticides and, most recently, rodents have become resistant to a group of rodenticides known as the anticoagulants. Warfarin is the most widely used of these compounds which, as their collective name suggests, act by interfering with the clotting ability of the blood. Rats feeding upon bait containing an anticoagulant normally die from internal bleeding within a week to ten days. The discovery of the rodenticidal properties of warfarin and allied compounds about twenty years ago heralded a breakthrough in rodent control. Warfarin-type compounds were not only extremely effective and safe in use compared with the older, acute poisons such as arsenic: they were also very cheap and simple to apply. By the middle or late 1950s warfarin had justifiably won a dominant position in the rodenticide market in Britain and throughout the world.

Resistance to warfarin

It was, therefore, a matter for concern when the first case of resistance to warfarin was discovered in 1958 among rats on a farm just outside Glasgow.

It soon became evident that the resistance, by the time it had been discovered, had already spread extensively. The inadequacy of the acute poisons, the only alternative rodenticides, now became all too apparent and it was a practical impossibility to exterminate the resistant population. The area in Scotland now affected by resistance covers upwards of 800 sq. miles. The second significant report of resistance concerned two farms in Montgomeryshire in 1960. Here, despite the vigilance of local pests officers and health authorities following the Scottish outbreak, the resistance was once more not discovered until it had spread too far to be stamped out, and today resistant rats occur in an area of at least 1,000 sq. miles in Montgomeryshire and Shropshire. A third outbreak was discovered in 1968 in Kent where resistant rats are now known to have spread through an area of 40–50 sq. miles. These are the only areas where resistant rats are known to have become established in Britain. There have, however, been a number of instances in Somerset, Gloucestershire and Nottinghamshire where outbreaks have been identified at a sufficiently early stage to make eradication of the resistant rats feasible by intensive use of acute poisons. Most recently rats resistant to warfarin have been found in Berkshire and Carmarthenshire. It is, however, as yet too soon to be sure that the attempted elimination of these outbreaks has been successful. In continental Europe resistant rats are well established in Denmark, whilst in Holland a small outbreak, early in 1968, appears to have been stamped out. Less well authenticated instances of resistance to warfarin in rodents have been reported elsewhere in the world, for example in the sugar cane fields of Guyana and in the rice paddies of Ceylon. It seems possible that wherever warfarin is intensively used for a substantial period of time rodent populations may have the capacity to respond by developing resistance.

Research

A small group of biologists in the Ministry of Agriculture, Fisheries and Food's Infestation Control Laboratory engaged in research on harmful mammals has been closely involved in the problem of warfarin-resistance since it first occurred. Their work includes severely practical, on-the-spot investigations of new outbreaks of resistant rats and also more theoretical studies aimed at elucidating the nature of resistance and the variables influencing its spread in rat populations. It is only by exploring a whole comlex of biological factors, ranging from the feeding behaviour of the rats to their physiology and genetics that the resistance problem can be adequately understood and laid open to attack.

The recent discovery at the Laboratory of genetical linkage in rats between resistance of the Shropshire-Montgomeryshire type and coat colour is one more step forward, albeit to the layman a rather esoteric one, in understanding the problem. In particular this linkage provides one of the most convincing kinds of evidence showing that the resistance is passed from parent to offspring by means of a single heritable unit or gene. This is important because resistance, if due to a single gene, can spread more rapidly through the rat population than if several different genes are involved. Because the resistance gene has now been genetically mapped with reference to other genes determining coat colour, it will also be possible to say more precisely in future whether new instances of resistance are of the same or of a different kind.

Overcoming resistance

The main research projects at the Laboratory are, however, linked in a more obvious way to the practical problems of overcoming resistance. One such experiment has been an attempt to isolate the resistant rats in Shropshire and Montgomeryshire. Between 1962 and 1965 surveys indicated that the resistant rat population was expanding across the countryside at the rate of about three miles per year. In 1966 an intensive survey established the limits of resistance and a zone roughly three miles wide was delineated around the perimeter of the resistance area. All the places likely to harbour rats on this perimeter or containment zone were systematically inspected and every infestation that was discovered, small as well as large, was treated with acute poisons. Every farmer in the containment zone was also asked to call in a special, free, rat-destruction service being operated by the Ministry whenever rats appeared on his land in future. It should be emphasized that this containment scheme was a purely experimental project by means of which it was hoped to discover whether, by increasing the efficiency of rat destruction and by imposing the maximum voluntary restraint on the use of anticoagulants in the containment zone, the outward spread of resistance could be halted. Unfortunately, events seem to have conspired to reduce the success of the scheme. First the epidemic of foot-and-mouth disease that affected the area in 1967 imposed restrictions on the movement of Ministry operators so that for a period of some months they were unable to visit all the farms requiring treatment. Second a considerable number of farmers in the containment zone continued, despite all efforts to persuade them otherwise, to use warfarin. This, by selectively eliminating susceptible rats, helped the resistance to become firmly established in the containment zone. Eventually, monitoring operations showed that in 1969 in a further three mile wide zone outside the containment zone a small proportion of the rats were resistant. This proportion, small though it was, showed conclusively that the effort to contain the resistance had not succeeded. It can be predicted that increasing difficulty will be experienced in dealing with rat infestations just outside the containment zone by means of anticoagulants. To the extent that the containment scheme has slowed down the spread of resistance and so gained time for the development of other countermeasures it has, however, provided a useful breathing space.

One of the more significant features of the situation in the Shropshire—Montgomeryshire resistance area is that, in spite of the fact that about a third of the farmers are continuing to use warfarin-type compounds, the incidence of resistance among the rat population appears to have reached a plateau. It will be obvious that if susceptible rats are being selectively destroyed by warfarin then the proportion of resistant animals should be increasing. The only possible explanation for such stabilization of the resistance is that the resistant rats suffer some disadvantage relative to the susceptible rats in respect of environmental pressures other than the use of warfarin. The possible nature of this disadvantage has been revealed by the work of a group of American bio-chemists studying resistant rats descended from animals sent across the Atlantic from Infestation Control Laboratory some years ago. They have found that the resistant rats require more vitamin K than do susceptible rats to keep them in good health. In the field it is quite likely that the amount of available vitamin K is, at times, insufficient to maintain resistant rats while being quite adequate to sustain susceptible

animals. These observations strongly suggest that if anticoagulants could be completely supplanted by other rat poisons in the area affected by resistance then not only might the further spread of resistance be prevented but also the resistant rats would dwindle in numbers over the years and perhaps eventually disappear.

Use of rodenticides

There are, unfortunately, many difficulties in the way of any serious attempt to regulate the use of particular rodenticides in this way. While common sense dictates the strategy of using only non-anti-coagulant rat poisons, this can prove difficult in practice because the effective alternative poisons are much more dangerous to humans and livestock. There would be a very much greater incentive to users of rodenticides to switch from warfarin if an equally safe and effective alternative were available. Again, the provision of satisfactory alternatives to the anticoagulants would be the best long-term protection that could be offered to people living outside the existing resistance areas and would enable new outbreaks of resistance to be stamped out much more easily than at present. For these reasons the highest priority is given at Infestation Control Laboratory to the search for new compounds suitable for use as rodenticides. The prospects of success in this project are difficult to evaluate and no one can be sure just how soon or how long it will be before a compound as good as warfarin is discovered. The pharmaceutical, pesticides and chemical industries are playing a major role in the project by providing, for testing, samples of novel compounds synthesized by their teams of chemists. The Laboratory itself has no commercial interest in the compounds and is in effect making special facilities and expertise available to industry. This approach is of mutual advantage because in the pharmaceutical industry, for example, thousands of new compounds are synthesized each year which eventually turn out to be useless to medical science; many such compounds prove too toxic to be used as drugs and it is precisely this sort of compound that is likely to be of greatest interest as a possible rat poison.

Up to the present there has been no obvious increase in rat infestation as a result of resistance in Britain, possibly because the areas that have been affected so far have been predominantly rural in character. Rats have always been quite numerous in the countryside and though undoubtedly farmers are, on occasion, having problems in dealing with resistant rats, they can, in general, keep infestations down to a fairly low level by the use of acute poisons. If however resistant rats were to spread into urban areas—and it is here that, with warfarin, rat control has been as intensive and successful in Britain as anywhere in the world—local authorities would encounter difficulties in maintaining standards by the use of acute poisons. But, provided the necessary resources are allocated to the work, urban rat control need be no less effective than it was before warfarin came into general use. Fortunately, however, it is likely to be some years before this situation arises and there is a good chance that research will provide an answer to the problem in the meantime.

This article has been contributed by **J. H. Greaves, B.Sc., M.I.Biol.,** of the Ministry's Infestation Control Laboratory at Hook Rise South, Tolworth, Surrey.

Haydn Davies, District Agricultural Adviser for N.A.A.S. in Cheshire, discusses current and likely future grassland husbandry problems associated with intensive milk production.

Grassland Problems

INTENSIFICATION often accentuates existing or creates new husbandry problems. The intensification of milk production has not been without its accompanying grassland husbandry problems. The purpose of this article is to review some of the techniques evolved by the more progressive Cheshire milk producers to overcome these grassland problems.

Poaching

Poaching or treading damage is probably the biggest single grassland problem associated with intensification and is, of course, most acute on heavy or ill-drained soils. The short-term effect is to reduce the amount of regrowth. The long-term effect is that of botanical deterioration since the grasses killed by poaching are usually replaced by inferior weed grasses. On both scores production is severely curtailed.

Poaching damage can be minimized by:

Sowing grass varieties that have a natural resistance to treading. The phenomenal rise in the use of S.23 perennial ryegrass and its Continental-bred counterparts (e.g., Melle and Sceemptre pasture) for reseeding pastures mainly intended for grazing, no doubt reflect their usefulness in minimizing treading. These grasses have a thick-knit and prostrate growth habit which greatly assists in preventing the direct contact of hoof and soil. Since they are heavy tillering, such grasses also tend to recover more quickly from poaching damage. They do, however, suffer from the disadvantages of (a) being slow to establish and often do not reach their best until two or three years after reseeding, (b) relatively late to begin growth in spring.

Good permanent pasture is the epitome of a poaching-resistant pasture. Where intensive grazing is to be practised, there is much to be said for retaining permanent pastures, provided they are of reasonable botanical composition and are responsive to fertilizer. Even where the botanical composition of the sward leaves something to be desired, two or three years of intensive controlled grazing, coupled with fertilizer use, will do much to improve sward composition and increase herbage production.

Over-sowing. In the past, this technique has been mainly used for renovating the more badly trodden areas such as around gateways. The very wet spring of 1969 saw an increase in the use of this technique to reseed much larger areas.

Success with this technique is largely dependent upon sufficient soil moisture during the critical stages of seed germination and establishment. Any husbandry measures that can be employed to minimize drying out will enhance the likelihood of a successful establishment. Such measures are to ensure:

1. A fine surface tilth to help cover the seed. This is usually best obtained by using heavy chain harrows with the spikes to the ground. All too frequently, however, the physical condition of the soil after severe poaching is so poor that the requisite fine tilth is very difficult to obtain. As with any soil cultivation technique, timing in relation to the stage of drying out is important.
2. Use of a heavy roll after sowing.
3. Use of a quick germinating, vigorously establishing grass variety, e.g., Italian ryegrass or S.24 or similar early heading type perennial ryegrass varieties. Seed cleanings, because of their cheapness, are ideal.

In practice, however, patching up in this manner, is in the vast majority of cases, only satisfactory as a short-term expedient until reseeding can be undertaken.

Shallow subsoiling. Repeated poaching results in damage to the structural elements of the surface soil. This impedes surface drainage and so not only increases the likelihood of further poaching but also conceivably restricts grass root development and the absorption of nutrients and soil moisture. This could explain the situation sometimes found on badly poached pastures where, even though heavy nitrogen dressings are applied, there is a poor growth. Empirical experiments in Lancashire and Wales have shown that the removal of this trapped surface water by cultivation at a depth of about 9 in., using a subsoiler specially designed for shallow working, considerably improves the growth of the herbage. Replicated quantitative trials to measure the value of this technique have recently been started in Cheshire.

Zero-grazing. One ultimate answer to persistent poaching is of course zero-grazing. Three well-known heavily stocked clay-land farmers in the county are now, primarily because of the poaching problem, wholeheartedly committed to zero-grazing. At current stocking rates, it is felt by the majority of farmers that the disadvantages of zero-grazing outweigh the advantages. If stocking rates continue to increase many will be keeping the situation under review. Zero-grazing as a short-term expedient in the early spring and late autumn has been a regular feature of many farms for some years past.

Economic use of nitrogenous fertilizer

Some milk producers are suspecting that they may be beginning to exceed the economic optimum level of usage. Unfortunately, little generalized advice can be offered on this matter since it depends upon the complex inter-play of a wide variety of factors, many of which are difficult to quantify. Some guidance may be obtained from a consideration of the more important factors that determine nitrogen requirement. These are:

1. Intensity of stocking.
2. Whether the grass is predominantly grazed or cut.
3. Amount and distribution of summer rainfall (both seasonal and geographical variations occur).
4. The contribution, if any, of clover.
5. Efficiency of utilization of the herbage grown (grazing system and conservation method).
6. Amount of concentrate feed supplementation.
7. Length of grazing season.

With the fairly large-scale adoption of paddock grazing, and its associated tendency to divide the grassland into a mainly grazing and cutting area, the question is posed—what allowance, if any, should be made for the re-circulated N on the grazed area? It is apparent that some allowance should be made for this, but more guidance is badly needed on this matter. Rule of thumb guides now in common practice for intensively stocked farms (i.e., about 1¼ acres per cow or less) on the split grazing/cutting system is about 250–300 units per acre per annum on the mainly grazing area, and 350–400 units per acre per annum on the mainly cutting area.

Where more conventional alternate cutting and grazing is practised, there seems to be general agreement that two units of N per acre per day of rest period between two consecutive defoliations is about right, i.e., about 40 units per acre dressing for a three-week grazing cycle and about 80–90 units for a six-week cutting cycle. This involves applying about 300 units to each acre of grassland during the season.

Where maximum herbage production per acre is required, it is becoming increasingly appreciated that full exploitation must be made of the spring flush. This is in recognition of recent research work from the Grassland Research Institute that has shown that responses in terms of lb D.M./unit of N is almost twice in spring to that of other times of the year. In other words, about half the seasons' growth potential has occured by early June. Hence the justification for using 100 units of N or more per acre as the first spring dressing, particularly for herbage intended for ensilage.

Pasture fouling and herbage refusal

Refusal of herbage by the livestock due to fouling or tainting with dung during intensive grazing has been less of a problem than anticipated. It has been common experience that if a grazier perseveres with an intensive grazing system over two or perhaps three seasons, herbage refusal appears to diminish gradually to an acceptable level. The reason for this is not known, but two theories have been put forward:

1. Much more rapid breakdown and disappearance of the dung pats due to the increased organic life of the soil (insects, earthworms and micro-flora and fauna) resulting from increased soil fertility.
2. Acclimatization by the cows to fouled herbage. That this can occur, has been demonstrated at Great House Experimental Husbandry Farm.

If, in an intensive grazing system, grazing efficiency, and herbage intake by individual animals, is not adversely affected, then there is much to be said for separate grazing and cutting areas. For example,

1. Grazing can be confined to the more accessible and convenient fields, so reducing the walking of the cows, fencing, road upkeep and water provision to a minimum;
2. Permanently maintaining the acclimatization factor.

Winter kill

This assumed some prominence in Cheshire after the two winters of 1967/68 and 1968/69. Although kill occurred in pastures under a wide range of intensities and systems of management, it appeared to be more prevalent in intensively managed pastures.

There is very limited scientific knowledge as to why or how such killing occurs and more research is needed. Field observations, however, suggest that the main management factor associated with killing is that of allowing the sward to go into the winter carrying excessive herbage. This apparent association was particularly noticeable in the spring of 1968 after stock had been housed unusually early in the previous autumn as a precautionery measure during the foot-and-mouth disease epidemic.

Heavy nitrogen usage, and in particular applying nitrogenous fertilizer later than the end of August, aggravates the situation. This is particularly so when the ground becomes very wet before the herbage can be fully utilized. Where the economy of the farm relies on autumn grass, one cannot, however, justifiably recommend withholding post-August nitrogen since there is no guarantee that its application will result in winter killing. Conversely, there is no guarantee that withholding post-August nitrogen will prevent winter kill occurring.

The type of grass is of some significance. Both Italian and perennial ryegrasses are more susceptible to killing than timothy, meadow fescue and tall fescue. Varieties within a species, however, differ greatly in their susceptibility, e.g., R.V.P. Italian ryegrass is less susceptible than S.22 Italian ryegrass; S.23 perennial ryegrass is less susceptible than S.24 which in turn is less susceptible than S.321 perennial ryegrass. (This latter variety is notoriously susceptible to frost killing and for this reason its use is not recommended for the more northerly counties of England.)

Grass renewal

No matter how good the grassland management may be some reseeding will probably be necessary. On heavily stocked all-grasss farms this presents a problem in that much needed grassland is out of production for 6–10 weeks if the more usual spring or summer reseeding is undertaken. For this reason, autumn reseeding is gaining rapidly in popularity since it minimizes loss of production. To ensure that an autumn reseed is sufficiently well established to withstand frosts, sowing before mid-September is highly desirable. Where the slower establishing grasses such as the timothys, cocksfoot, meadow fescues and pasture-type perennial ryegrasses are to be used, then sowing by the end of August is recommended.

Acknowledgment

I wish to acknowledge the encouragement given by Mr. R. Hope my County Agricultural Adviser and the guidance of Mr. J. Ormrod, Regional Grassland Adviser, West Midland Region.

Further reading

Ministry Bulletin No. 154 *Grass and Grassland*, which describes the production and upkeep of grassland, the best use to make of it and the profits that can be expected from it. (114 pages) price 9*s*. 6*d*. (by post 10*s*. 2*d*.) from HMSO (addresses on p. 148).

THE AUTHOR

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discusses the preservation and processing of food

Food Technology

SINCE earliest times man has sought to store foods surplus to his immediate requirements for use in times of need. Often the raw foods became spoilt by micro-organisms, but gradually man has acquired a basic understanding of how to modify or preserve foods in order to increase their storage life. For several hundred years farmers have supplied townspeople with much of their food, but it is a consequence of the increased urbanization during the past hundred years that the majority of people have come to rely on the ready availability of preserved and processed goods in addition to the seasonal availability of fresh foods. The trend towards the use of processed 'convenience' foods has increased considerably over the past thirty years.

The food industry, which has developed for the large-scale conservation of food, occupies a position intermediate between agriculture on the one hand and the consumer on the other. The food and drink industry is the second largest manufacturing industry in Britain, the gross output for 1963 (the latest year for which statistics are available) being worth £4,477 million. The food industry also employs approximately one tenth of the total manpower engaged in the manufacturing industries. In 1966 retail sales of food amounted to approximately £5 million, this being equivalent to almost 50 per cent of the value of all retail sales in that year.

Origins of food technology

Many of our methods of food preservation have their origins in folk-lore and some of the earliest references to the preservation of foods are to be found in the Bible. References to the production of bread, butter and cheese occur in the books of Genesis, Exodus, Samuel 2 and Job which are believed to date back over 3,000 years. The drying and salting of meat and vegetables, the fermentation and salting of meat and vegetables, the fermentation of milk, fruit juices, malt and barley, and the use of underground chambers for the cool-storage of perishable foods are examples of some traditional methods of food preservation. Some industrial processes have their origins in these traditional methods although modern techniques are much more sophisticated. The use of heat preservation for food dates from the early nineteenth century, canning of foods from 1809, and the pasteurization of wines and

other liquids stems from the work of Pasteur and others in the mid-nineteenth century. Other processes, including quick-freezing, freeze-drying, the use of chemical preservatives, etc., are recent advances in process techniques. The tin can, invented in 1810, has been widely used as a food container although aluminium cans and tubes, and flexible plastic and plastic-laminated foil pouches are now being widely introduced for the packaging of raw, frozen, dried and heat-processed foods.

Scope of food technology

Food technology can be defined as the application of biological, chemical, physical and engineering sciences to the preservation, processing, packaging and storage of foods. The preservation of foods ranges from the use of techniques such as the drying and deep-freezing of meat, fish and vegetables to heat processing of canned foods, milk, etc., and to the use of chemical preservatives in raw and partially processed foods. The modern food industry is a complex of closely related industries including those responsible for flour milling, baking, brewing, chocolate and sugar confectionery, milk and dairy products, margarine and cooking fats, dehydration, quick-freezing, bacon curing, meat and fish processing. Even within these general groups many variations occur; for instance, the term 'dairy produce' covers not only bottled pasteurized and sterilized liquid milk, but also evaporated and condensed milks, dried milk, ice cream, butter, cheese, yoghourt, etc. The process operations involved in the preservation and processing of many foods are common in principle but they vary in detail according to the nature of the product.

In addition to the preservation of foods *per se*, the food technologist is concerned with the development of new types of processed foods and with new recipes for established commodities. Product development and research is of considerable importance for the economic viability of commercial firms in a highly competitive market. In the development of new food products the food technologist will frequently work in close collaboration with chefs and domestic scientists. Even when a new recipe has been devised the technologist has to follow the new product through trial processes starting in the experimental kitchens and passing through pilot scale manufacture to a full-scale commercial process. During the development period, problems concerned with the increasing scale of manufacture have to be overcome. Such problems will range from the availability of suitable raw materials at an economic price, to the blending and mixing of the food constituents on a large scale and the packaging and preservation of the food. When a suitable large-scale formulation and process has been devised, the product will then normally be placed on a commercial trial to assess the reaction of the public to the new product.

Large-scale production has an inherent disadvantage in that the process may affect the colour, texture or nutritional value of the food. To offset this disadvantage small amounts of permitted artificial or natural flavours, spices, emulsifying salts, colours or vitamins may be added to certain processed foods. Foods which are not given a heat process may often be preserved by the addition of small amounts of preservatives to retard spoilage of the food after preparation. Whilst there are many advantages and disadvantages in the use of food additives, their use is strictly controlled by law and is frequently reviewed by the Food Standards Committee of the Ministry of

Agriculture, Fisheries and Food which then makes recommendations to the Government about their continued use in a given situation.

Nowadays there is a constantly increasing demand for 'convenience' foods which require a minimum of preparation by the housewife. Convenience foods include most forms of canned and quick-frozen foods, and the increases in the indices of real value of purchase of convenience foods during the years 1960–1966 are illustrated in Table 1. The increasing sales of quick-frozen vegetables are shown in Table 2. Apart from ready prepared, canned or frozen meat, fish and vegetables, which are available to the housewife throughout the year, many companies have introduced the concept of deep-frozen or canned 'complete meals' which only require cooking. With the introduction of infra-red ovens quick-frozen ready-cooked meals are available to caterers and housewives and permit 'instant meals' to be served. Whilst such meals will be nutritionally satisfying a potential danger exists that meals may tend to lack variety; but the average housewife will use ready prepared meals only on rare occasions.

Table 1

Indices of real value of purchases of convenience foods (1960-1967)
(1963 = 100)

	1960	1962	1964	1966	1967
Canned foods	93·9	97·2	101·9	104·9	110·7
Quick-frozen foods	74·1	83·8	95·8	131·8	131·6
Other convenience foods	93·7	97·8	101·9	106·4	110·7
Total convenience foods	91·6	96·7	101·5	107·4	112·0
Total all foods	97·5	99·3	99·1	101·1	102·0

These figures have been extracted from *Household Food Consumption and Expenditure, 1967*—H.M.S.O.

Table 2

Production of quick-frozen vegetables in the U.K. (1961-1968)
(tons net contents)

	1961	1963	1965	1967	1968
Beans, green	7,400	11,900	12,500	23,300	15,700
Peas, green	50,800	47,500	50,500	66,100	64,900
Brussels sprouts	3,200	7,100	3,900	9,500	6,300
Broad beans	1,800	2,400	1,900	2,000	n.a.
Potatoes and potato products*	—	—	—	—	25,500
Other vegetables	4,800	10,800	10,900	16,900	6,500
Total	68,000	79,700	79,700	117,800	118,900
Made up as follows:					
Retail packs	36,200	34,200	27,000	20,200	7,400
Catering packs	31,800	45,500	52,700	97,600	111,500

*In previous years included under 'Other vegetables'.
The figures contained in this Table have been extracted from *The Statistical Review* with permission of the Fruit and Vegetable Preservation Research Association.

Food technology is concerned also with the design of equipment for food processing and packaging. The design of processing machinery requires a theoretical and practical knowledge of the problems associated with the handling of foods, the nature of flow of solids and liquids, heat penetration characteristics, etc. Consequently, it is not surprising that the food industry has very close connections with the mechanical and chemical engineering industries.

Why preserve foods?

There are many ways in which foods may become spoilt and unsuitable for human consumption. Apart from direct contamination by undesirable chemicals (including taints picked up by storage in close proximity to materials such as paints and oils), foods may be spoilt biologically. Biological spoilage (or biodeterioration) can take many forms; in some instances foods may become spoilt merely as a result of the action of enzymes present within the food which cause undesirable changes to occur; or they may be spoilt by the growth of micro-organisms or through contamination by insect pests and rodents.

Because of its chemical composition most food materials serve as an excellent medium for the growth of micro-organisms and microbial spoilage can take many forms. The growth of moulds on grain results not only in a changed appearance but also causes chemical changes in the food which will affect the flavour of the flour. Futhermore, many moulds are capable of producing toxins which may cause disease in man and/or in animals. The growth of bacteria in foods results in spoilage ranging from the development of slime, taints and unpleasant aromas to the development of rancidity and putrefaction. Other bacteria may occur without causing overt spoilage but may cause disease to the consumer (e.g., salmonella food poisoning, typhoid, brucellosis from raw milk, etc.). The aim of the food technologist is to extend the shelf-life of foods by destroying enzymes and by destroying, or inhibiting the growth of, food spoilage organisms; but careful control of process conditions are necessary to minimize the loss of colour, flavour and nutritional value of processed foods. The preservation process is also aimed at destroying potentially pathogenic organisms to protect public health and to prevent the onset of food-borne diseases.

Preserved foods do not normally have an indefinite shelf-life under all conditions of storage, since the preservation process will not necessarily inhibit all micro-organisms present in the food. Pasteurised milk can be safely stored for several days at refrigeration temperatures without spoilage occurring, but slow growth of micro-organisms which have survived the heat process will take place and the milk will eventually spoil. Obviously such spoilage will be accelerated if the milk is not refrigerated. Sterilized milk has a much longer shelf-life than has pasteurized milk since very few micro-organisms will survive the heat process. However, on prolonged storage various forms of chemical or enzymic spoilage may occur, especially in the new type of ultra-high temperature sterilized ('long-life' milk). The destruction of micro-organisms by heat is also used for the preservation of canned foods. Although some foods may receive only a pasteurization process (e.g., canned ham, canned fruits, etc.) most canned foods are given a very high temperature heat sterilization process which is sufficient to destroy all but the most heat-resistant of bacterial spores. The shelf-life of 'commercially

sterilized' foods is normally indefinite, although spoilage can occur under certain conditions through growth of organisms which survive the heat process. Canned foods for use in the tropics are usually given a heat process in excess of that given to canned foods for consumption in the temperate zone to eliminate the extremely heat-resistant bacterial spores. A potential post-processing cause of spoilage in canned foods results from the ingress of micro-organisms through faulty seams or through pinholes caused by rusting of the tinplate.

Heat preservation is not the only means of preserving foods. The use of quick-freezing for meats, vegetables, fruit, etc., prevents the growth of spoilage organisms. However, the organisms are not destroyed and will grow rapidly once the food is allowed to thaw. Processes such as drying prevent microbial spoilage by removing water which is essential for microbial growth, but may not always prevent spoilage by enzymes. Conventional air-drying processes adversely affect the flavour, texture or appearance of some foods, whilst modern processes such as accelerated air-drying and accelerated freeze-drying generally produce fewer undesirable changes. Drying has the advantage that foods do not require refrigerated storage, but microbial spoilage may occur after reconstitution unless the foods are consumed within a short period of time.

Traditional processes such as the salt-curing of meats and bacon retard the growth of micro-organisms, as also does the use of other specific preservatives which are used in particular types of food to prevent the growth of yeasts, moulds or bacteria. Some kinds of processed foods are still subject to spoilage even under refrigeration conditions. Examples of foods with a limited shelf-life are sausages and meat pies; here the manufacturer will endeavour to ensure the absence of pathogenic organisms by the use of high-quality raw materials and by the use of good hygienic conditions during manufacture.

One form of preservation which deliberately uses the growth of micro-organisms is in the production of fermented foods. These include cheeses, yoghurt, sauerkraut and wines. When a fermented food is produced the nature of the raw material is changed to some extent and the conditions prevailing will normally be unsuitable for the growth of many spoilage micro-organisms. Nevertheless, spoilage can occur if raw materials are of poor quality or if the fermentation process does not follow the normal pattern. Many fermented foods available commercially are pasteurized in order to extend their shelf-life and, in the case of those such as yoghurt, to prevent excess acidity being produced to ensure a uniform palatable product. Wines may be pasteurized to prevent oxidation of alcohol by certain classes of wild yeasts and bacteria which would otherwise convert the alcohol to acetic acid; preservatives may also be added to wines to supress the growth of undesirable organisms.

Role of the food technologist

The food technologist is concerned with many aspects of work within the industry. One very important role is that of the quality control assessment of raw materials and of the finished product so that the manufacturer can maintain certain standards for his produce. Quality control is concerned not only with the chemical and microbiological quality of the food but also with assessment of the hygienic standards of the process and with both the quali-

tative and quantitative aspects of food packaging. The technologist may also be concerned in supervision of plant operatives, in general management and in product and process research and development. Technologists may become involved to some extent in the marketing of foods and in public relations.

Training and career opportunities

Several career grades exist within the food industry ranging from technicians to technologists. The technologists will normally be recruited from graduates in food science and technology, and courses in these subjects are offered by several universities in the U.K. A four-year 'sandwich' course leading to a BSc (Food Technology) honours degree of Reading University is offered at the National College of Food Technology* to candidates who have a minimum of two A level passes in mathematics, chemistry, physics or biology. Other courses, including that in the Department of Food Science at Reading University, lead to honours degrees of B.Sc. (Food Science), and a number of technical colleges offer courses leading to a Higher National Diploma in Food Technology. Post-graduate training for science graduates who wish to enter the food industry can be obtained through specialized taught courses leading to MSc degrees in Food Technology* or Food Science, and by research for higher degrees. Graduates with suitable professional post-graduate experience are eligible for corporate membership of the Institute of Food Science and Technology.

Opportunities for employment exist not only in the food industry itself but also in Government service, in private research institutes and in technical and university teaching both in this country and abroad.

*Further information may be obtained from the Principal, National College of Food Technology, University of Reading, St. George's Avenue, Weybridge, Surrey.

Worrying of Livestock by Dogs

Year after year sheep and their lambs are killed and injured unecessarily because dogs are not kept under proper control in the countryside. People who live in or near the country and own a dog, or those who bring their dog to the country on a visit, should keep it under control at all times when there are farm animals about. Dogs that are apt to stray should be kept on a lead. The suffering and injury to sheep and other livestock can be reduced if dog owners behave in a responsible manner.

A dog not under control can be an expensive liability as there are severe penalties for allowing a dog to stray and worry livestock. The owner, or person in charge of it, is liable to prosecution and an action for damages. A court may order the dog to be destroyed. Every year people in England and Wales are fined for offences committed by their dogs against livestock. The maximum penalty for owning or keeping a dog which behaves in this way is £20 for the first offence and up to £50 for a second or subsequent offence.

Agriculture and Horticulture in Malta

A. G. Healey

'For eight months of the year Malta is delightful, but in summer a drearier place eye never saw. Nothing green meets the eye.'

Thus Samuel Taylor Coleridge, writing in 1804, during a post-Ancient Mariner period as an unlikely Secretary to the Governor of Malta. But the quite erroneous impression that Malta is a barren isle still remains, fostered perhaps by the first sighting from the air as the 'plane circles round preparatory to landing, when all the visitor can see is a patchwork of small, lion-coloured, awkwardly-shaped fields bounded by stone walls.

Malta is very much in the news these days. The National press has recently devoted special supplements to the affairs of the island, and many thousands of British tourists are visiting Malta in search of sun and sea in a sterling area. My own visit was an official one, as a guest of the Department of Agriculture, to discuss the training of additional advisory staff.

The population of Malta is approximately 400,000, inflated each summer by an influx of some 170,000 visitors. There is at present a considerable strain on the islands' resources because of the rapid development of new building. Much of the property is being bought by retired English and other people with the result that prices have increased rapidly. Consequently, the indigenous Maltese find it difficult to buy or rent houses for their own occupation at reasonable prices.

The area of the three islands of Malta, Gozo and Comino is 121 square miles, of which some 35,000 acres are under cultivation.

Soil, water and shelter

The three main problems limiting agricultural and horticultural production would appear to be:

1. soil conditions,
2. the lack of water for irrigation, and
3. wind.

If the triple-fold problems of soil, water and shelter can be overcome, then the intensity of production in the island could be very high, because of the temperate weather and the hours of sunshine.

The value of shelter was strikingly seen on the island of Gozo, where in one field the young peach trees in the nursery and next to the shelter wall were four times the size of trees growing further out in the field and removed from shelter. This effect was slightly exaggerated because of the channel-cum-furrow irrigation, which results in more water being available to the plants nearest the channel against the wall. Nevertheless, it was obviously largely a question of shelter. An interesting side issue on soil problems was also seen again on Gozo. It is a legal requirement that soil taken from building sites must be used on agricultural land. I saw one large field which was being resoiled but it was obvious that the consignments arriving were very mixed in quality, and differing rates of plant growth were seen on fields earlier resoiled in this way. Last year nearly 72,000 cubic yards of top soil were deposited.

The soil is calcareous, with limestone underlying. The limestone can be readily sawn to provide building materials. On one holding a quarry is being made by cutting out stone for building purposes with the intention of flooding the quarry, a neat cube, to provide water for irrigation. Many parts of the island are at present beyond cultivation because of rocky outcrops and poor soil. The incidence of lime induced chlorosis is high, and there were signs of very severe iron deficiency in young peach trees on Gozo. I was told that this was readily cured under Maltese conditions by spraying with FeEDTA (ethylenediaminetetraacetic acid).

Nearly all the rainfall comes in the winter months. There are exceptional occasions when nature overdoes her bounty—in September 1969 nine inches fell in 48 hours—but it is clear that one of the problems of production in Malta and Gozo is indeed the lack of water, either by natural precipitation or for irrigation. In the nature of things irrigation water has to come from underground sources and much of it thus produced is brackish. There is much furrow irrigation by means of directed open stone channels and temporary earth furrows amongst the crop. This would appear to be wasteful and high in evaporation but as most of the holdings are small, capital outlay on pumps and pipes for irrigation present difficulties. At one point, I saw a mule being used blindfolded to drive a windlass pump to raise water to a tank at a higher level, from which it gravitated in channels and then in open furrows over an adjoining holding.

There are 156 underground reservoirs, and a new desalination plant produces 800,000 gallons of water per day, all badly needed. It is calculated that less than 2,500 acres are at present irrigated.

The Department of Agriculture also transports water in water-carts, or 'bowsers', to growers and gardeners at a charge of 10*s*. for 1,400 gallons delivered.

Nurseries and other holdings

The first nursery I visited, in the company of Mr. Calamatta, a former student and now a horticultural advisory officer, was that owned by Mr. Richardo Borg. It is typical of the newer, small but intensive glasshouse nurseries in the island. Mr. Borg, although still a young man, has ten children, some of them old enough to assist with the running of the holding in school

Sparkes nurseries—35 million cuttings a year

holidays. Carnations are planted in late June, to flower in December and are treated as an annual crop for export. The tomato crop had finished under glass, the aim being to produce a very early crop for export. Seeds are sown in August and picking starts about 10th December. The main variety grown is Fountain Cross, a Guernsey variety which has proved particularly suitable for conditions in Malta. The winter temperature drops to about 39°F (4°C) but seldom lower, although paradoxically ice has formed occasionally under the unheated polythene structures, presumably because of the inability of polythene to hold back radiated heat.

Close to Mr. Borg's nursery is another holding of both glass and outside land owned by the Budeja brothers. It was noticeable that fields of gladioli were not being cut, because gladiolus rust (*euromyces transversalis*) had recently affected the crop, causing a temporary cessation of exports to Britain. Here again tomatoes are produced for the early trade and it was obvious that the crops had been heavy and in keeping with early crops in Britain, largely, I gathered, because of the development of new techniques on advice of the advisory staff. The crop had been produced by trough and whale-hide pot growing, supplemented by steaming. A russet-mite which can seriously affect tomatoes is readily controlled by malathion. Peat in bales was noticeable in abundance on the holdings.

The holdings, with the exception of Messrs. Sparkes, seen later, are untidy by home standards, due to the scarcity of labour on these family holdings where no time is spent on work other than growing the crop.

Of special interest was the mushroom unit established by an English expatriate, Mr. Howard, at Rabat. Mr. Howard is using the disused railway tunnel once used by the railway operating between Rabat and Valletta. All production is in trays and technically is of a high standard. A small railway track was being laid to serve the cropping units in the long, narrow tunnel.

I visited the Government Experimental Farm, used for both horticulture and agriculture. The average lactation of the cow herd has been raised from 600 to 800 gallons and they have every confidence in reaching the 1,000 gallon mark quite soon. The animals being maintained under cover or in yards all the year round. Indeed I saw no grazing animals during the whole of my stay

and saw only two tractors, both points indicative of the small units and land scarcity. In the glasshouses we saw work in progress on tomatoes, cucumbers, carnations, roses and gerbera jamesonii. The aluminium used in glasshouse construction was in places corroding very quickly, for reasons which are not clear. Trouble has been encountered with the ill-health of roses on the root-stock *Rosa indica*.

Growers in Britain usually associate horticulture in Malta with Messrs. Sparkes, who produce 35 million cuttings of chrysanthemums and carnations each year from an impressive five acres of 'glass'. There is very little in the way of glass cover, most of the protection being provided by polythene or 'saran', a close-woven type plastic material.

The technical advisory staff suggest that the future of horticulture in Malta lies with the production of early produce—vegetables, flowers and fruit—taking advantage of the climatic features. Malta is self-sufficient for milk, and 14,000 tons of early potatoes are exported annually. Tomatoes are exported in January, carnations in December, and melons in July and August. Other increases in production have been in onions and wine, the local grape growing being expanded markedly. Mushrooms also offer a possibility of expansion, although limited by the supply of manure. They are interested, for obvious reasons, in the development of synthetic composts. The export of agricultural and horticultural products has risen in value from £864,000 in 1964 to £2,336,000 in 1968.

The prickly pear, *Optuntia ficus indica*, is prominent everywhere. It is used occasionally as a hedge-cum-windbreak and also provides cattle food. In places it appeared to have assumed dominance, in conditions not subjected to cultivation.

An impressive feature of Gozo, the second island, is the Government plant nurseries. These are small, separated units, originally gardens attached to properties that have been taken over. The Department of Agriculture is responsible for public parks and highways and does a considerable amount of propagation of trees and shrubs for its own use and for sale to amateur gardeners.

A large quantity of peach trees is being raised on bitter almond rootstocks. One field had been sown in the open in October, 1967, and had produced trees suitable for budding in June, 1969. Budding is by inverted shield budding, supposedly because rain might enter the top of the T-cut if placed in the normal English fashion. This is interesting in an island which is so short of rain. The buds are cut carefully at both ends to form a definite patch rather than an elongated shield. The rate of insertion appeared to be slower than we would expect in this country, due partly to the method of insertion, which since it involves an upward rather than a downward movement is probably slower. The workers were squatting on stuffed sacks rather than working in a bent position, but the speed was quite reasonable and the percentage take would appear to be high.

The Department raises each year, in Gozo, 15,000 fruit trees of various kinds, selling them at 1*s*. 3*d*. each to registered farmers and at 2*s*. 6*d*. each to amateurs.

Department of Agriculture

The extension service given to growers is obviously of considerable value, and is increasing rapidly.

Glasshouse border steaming is carried out on contract by the Department at the low rate of 8*s*. 6*d*. per hour of actual steaming, all transport costs being carried by the Government. This assistance to glasshouse crop growers is part of a deliberate policy, with special reference to the export trade. Government capital assistance is on a basis of 40 per cent grant and 60 per cent loan, on which 6 per cent interest is charged. The grant and loan system covers the provision of glasshouses, piggeries, overhead irrigation, tractors and reservoirs.

I was told that all farmers are registered by the Survey and Land Department so that the use of every field on the island and its ownership is recorded centrally in detail.

In addition to the Maltese advisory officers, trained in England, United Nations Food and Agricultural Organisation staff members are working at various levels, attached to the Department of Agriculture. I met, amongst others, an Italian responsible for fruit, a German interested in fertilizers and plant nutrition and an Englishman who had been seconded to assist with glasshouse problems. The Civil Service starts work at 0600 hrs during the summer and stops at 1300 hrs, although I was assured that this was only a theoretical working day as far as the advisory staff were concerned.

All told I was very impressed by the efforts being made to overcome difficulties by the application of enthusiasm and technical knowledge. Problems remain, but one is confident that they will be overcome.

This article has been contributed by **A. G. Healey, N.D.H.**, who is Deputy Principal at the Essex Institute of Agriculture.

Home-grown Cereals Authority
Extended Research and Development Powers

An Order extending the research and development powers of the Home-Grown Cereals Authority under the Cereals Marketing Act 1965 came into operation on 29th January, 1970.

The Authority will now be able to sponsor research projects concerned with the development of existing uses of home-grown cereals. Previously its research powers were confined to *new* uses and processes. It was therefore unable, for example, to concern itself directly with research aimed at increasing the proportion of home-grown cereals in animal feedingstuffs or developing new types and strains of cereals. Any projects in the latter category will be undertaken only after consultation with the Agricultural Research Council, which has a general responsibility for co-ordinating agricultural research programmes supported from public funds.

The new Order is the ***Home-Grown Cereals Authority (Additional Functions) Order 1970 (S.I. 1970 No. 65). Section 7***, copies of which can be obtained from H.M. Stationery Office (***addresses on p. 148***), price 6*d*. (by post 10*d*.)

Better Returns from
Welsh Mountain Ewes

M. Roberts, *Director of Pwllpeiran E.H.F.*

The Welsh mountain ewe, regarded by many as the best in the country, is in danger of being relegated to third or fourth position. This is being brought about partly by mismanagement and partly by changes in the demands of the market.

Market requirements

The lamb that is in demand and commanding the highest price per pound is in the range of 29–38 lb dead weight. There has been an immediate reduction of 3*d*. a pound for lambs below this weight range, but only 1*d*. per pound for lambs between 38 and 43 lb. In other words, nowadays the small lamb is being penalized far more than the heavy lamb. If one compares the value of two carcases, one of 26 lb with one of 30 lb, there is a difference of 22*s*. 6*d*. in favour of the heavier lamb.

There are several reasons for this, but the most important is that the costs of transport and slaughter are virtually the same at about 10*s*. per lamb irrespective of its weight. There is also a suggestion that the medium-sized carcase is better suited to the present-day system of cutting and the production of the highest percentage of saleable joints to the modern housewife.

It would, therefore, appear that the value of the small lamb is likely to deteriorate still further if this trend continues to develop.

Satisfying the market

There is no doubt that the Welsh ewe, well bred and given the opportunity to rear its lamb to its full potential, is quite capable of producing what the market requires. There are many instances of well managed mountain flocks where the carcase weight of Welsh lambs are averaging over 32 lb. There is, however, a preponderence of small lambs coming on the market in some of our hill areas.

The November returns at a market in a typical area of Wales show that the small lamb predominates. During the five-week period (weeks 32–36) 87 per cent of the lambs offered for grading were estimated to be 28 lb and under; 62 per cent of them were classed at between 17 and 26 lb carcase weight. This five-week period has been taken as the time when the bulk of the lambs on offer would be true hill lambs, i.e., lambs reared on the mountain and then fattened on a green crop or lowland grass.

In the present situation, 87 per cent of the lambs being entered for grading at this market during the period in question were not satisfying the market requirements and, therefore, not commanding the best prices. It may be argued that the best lambs may have gone before this period or that the better ones would be sold on the hook or carcase weight basis, but it could also be argued that the proportion of small lambs would most probably be higher still in the next five-week period.

Some factors affecting weight

Size of ewe. Size expressed as liveweight may not necessarily be very accurate, but, in the absence of a more positive system of measuring size, it is generally accepted that the weight of an animal in store condition has some relation to its size. There are several factors which can influence the eventual size or weight of an animal at various stages of growth to maturity. The size of both parents will have an influence both on the birth weight of the lamb and its weaning weight, other factors being constant. Table 1 illustrates that higher the weight of the mother, the heavier the lamb will be at weaning, and refers to the performance of some four hundred three-year old ewes under the same management and grazing on poor mountain land for eleven months of the year.

Table 1

Ewe weight in lb			Lamb weight in lb	
Range	*October*	*July*	*Birth*	*Weaning at 16 weeks old*
65—69	67·3	59·0	6·2	41·5
70—74	71·7	59·7	6·3	42·0
75—79	76·6	63·6	6·4	46·4
80—84	81·5	66·7	6·5	47·8
85—90	88·8	70·2	6·7	49·3

This information indicates that an increase of 10 lb in the weight of the ewe at tupping time (October/November) could well mean an increase of 4 lb in the weaning weight of the lamb the following August. The difference

in the value of a small store lamb of 41½ lb live weight and the fairly good lamb of 49½ lb could be quite substantial, since the competition and demand for the bigger lamb would increase the price per pound appreciably.

Level of nutrition. Another factor which influences the weight of the lamb is the level of nutrition during and after lambing. It is a well known fact that the ewe must be brought to full milk yield in the first month after lambing and post lambing feeding is often necessary to achieve this under hill conditions. Whether this milk yield is maintained at a satisfactory level sufficient for maximum development of the lamb depends on the quantity and quality of the grazing.

Table 2 refers to the performance of two tooth ewes rearing wether lambs on improved hill grazing and shows, not only the importance of the size of ewe on the weaning weight of the lamb, but also the influence of good grassland on performance, i.e., the weaning weights of the lambs of the two-year old ewes are better than those of the three-year old ewes in Table 1 grazing on the mountain.

Table 2

Ewe weight in lb			Lamb weight in lb				
Range	*October*	*July*	*Birth*	*16 weeks old*	*Slaughter weight*	*Dead weight*	*Days weaning to slaughter*
56—60	58·5	62·1	5·5	46·0	61·5	30·8	81·0
61—65	63·1	65·0	5·6	47·3	61·9	31·0	80·1
66—70	67·6	68·6	5·9	49·3	61·2	30·9	67·9
71—75	72·6	73·9	6·1	53·7	64·1	32·5	61·3
76—80	80·5	77·6	6·6	55·6	64·5	32·6	55·6

It is evident that when the Welsh ewe has the opportunity to express her full potential, even the smaller ewe is capable of rearing a lamb that will reach a marketable weight at slaughter but it is also clear that there is a greater difference between the weaning weight of the smaller lamb from the smaller ewe and the larger lamb from the heavier ewes grazing on improved land than under mountain conditions. The last column in Table 1 shows that the smaller lamb from the smaller ewe takes 25 days longer to reach a satisfactory slaughter weight than the larger lambs from the heavier ewes.

Some factors affecting size

Having established that better results can be expected from heavier ewes grazing on both mountain and improved land, it is reasonable to assume that where there is a preponderance of small lambs being produced, the ewes are also likely to be small. The two factors are inter-related and the small ewe lamb will on average be smaller at maturity than the well-grown and heavier ewe lamb. Rate of growth can obviously be influenced by breeding and careful selection of sires with a potential for growth should always be considered, but the full benefits of good breeding cannot be realized if nutrition is a limiting factor.

Although winter nutrition is always a problem, our experience at Pwllpeiran indicates that this can be overcome at a reasonable cost resulting in a good lambing percentage as well as having lambs of satisfactory weight at birth. Whether it pays to spend between ten and twelve shillings on feed to each ewe to achieve these two objectives will depend to a very large extent on the rate of growth of the lambs and their eventual value either as stores or fat.

Stocking density

In our experience at Pwllpeiran, the development of the lamb will depend not only on such factors as post lambing feeding but also on stocking density on the mountain. Wherever stocking density affects individual performance adversely, its validity should be questioned.

In 1963, we decided to reduce ewe numbers because we were dissatisfied with the performance of the very small ewes that had evolved under a fairly high stocking system. Table 3 compares the performance achieved in 1961, when the stocking was 2,220 ewes, with that of 1967, when the number of ewes had been at the lower figure of 1,900 since 1963/64.

Table 3

	No. of ewes	*Av. live wt./ewe in Oct. lb*	*Total wt. of wool produced lb*	*Wt. of wool per ewe lb*	*Lambing %*	*Total No. of lambs*	*Av. wean wt. per lamb in Sept.*	*Total livewt. of lambs produced*
1961	2,220	60·00	7,908	2·76	84	1,864	41·00	76,457
1967	1,900	70·55	8,766	3·55	95	1,805	46·34	86,348

Better returns from fewer ewes

It will be noted that although the number of ewes in 1967 is 320 fewer than in 1961, the production of both wool and lamb is greater. The ewes are 10 lb heavier and the lambs 5 lb heavier at weaning which means that both the draft ewes and store or fat lambs are in a more saleable condition. There is a great deal of room for improvement still in this direction, since nearly a quarter of our lambs are killing out at 28 lb or below. One would not consider the position to be satisfactory until this figure could be brought to around 10 per cent or below. It may well be necessary to reduce our stocking rate still further, unless nutritional deficiencies on the mountain in the spring and summer can be remedied either by some form of feeding or by increasing the acreage of improved pastures substantially through an extensive programme of hill land improvement.

It is difficult to estimate the extent throughout Wales of this problem, but there is no doubt that the problem exists in the mountainous areas and especially in those areas where the natural hill grazings are overstocked. There has been an appreciable increase in the number of breeding ewes in Wales between 1962 and 1967. If this indicates a proportionate increase in the stocking rate, then the problem of too many small Welsh lambs coming on the market from some mountain farms must arise.

A comparison of the 1962 and 1967 returns during the five-week November period, mentioned earlier in this paper, at a market in a typical hill area, seems to indicate that an increasing proportion of the lambs being certified are in the low carcase weight category. In 1962, 58·4 per cent of the lambs certified were classified at 28 lb or under whereas in 1967 the corresponding figure was 84·2 per cent. In other words, the proportion of small lambs has increased appreciably when there has been a corresponding increase also in ewe numbers during the same period. This seems to be in line with our own experience that heavy and excessive stocking of hill and mountain grazings will result in increased numbers of small ewes rearing smaller lambs.

M. W. Shea, N.D.Agr.E, A.M.I.Agr.E., of the Department of Hop Research, Wye College, comments on the types of hop wirework that are used by Continental growers.

New Alsace design supporting a first year plant—which explains the inconsistent growth

Continental Hop Wirework

In the long history of hop growing, wirework, that is the trellis which supports the growing crop, is a comparatively recent introduction. It is thought that hop growing for brewing began about the year 800 A.D. in central Europe and some six and a half centuries later in England. Hops do not thrive unless they follow their natural propensity to climb upwards, so in early times they were trained up wooden poles placed annually at each hill. From the early history of the crop onwards, references were made to the high annual cost of providing these poles, which reduced the profitability of the crop, and to the disadvantages of such a system on cultural grounds. These considerations were the greatest spur to the invention of a permanent wirework system: stability in storm conditions was of slightly less importance.

The first reports of a system incorporating permanent wirework emanated from France in 1829: a M. Denis joined together pieces of wire each about three feet long, in the manner of a surveyor's chain; these were supported by oak posts at each end of the rows of hops, with additional props at intervals, and training strings were suspended from them. A scheme a little nearer to

present traditional construction was attempted by a M. de Dombasle in 1835. After this date, fairly rapid developments took place until the end of the century, by which time wirework was widely used on the Continent and in Britain.

Numerous systems were invented on the Continent and were well recorded in Germany and the old Austro-Hungarian Empire. The height range of these systems is interesting, varying from seven to thirty-three feet, although this latter height was described as rather unstable. There appears to have been a commonly-found range of thirteen to twenty-six feet and the middle of this roughly coincides with current European practice. Details of these schemes were very varied and included the use of iron pipes on brick foundations to support the wirework. Several schemes included horizontal timber spars to give rigidity to the structure: these were a feature of the Hallertau Bock system which was in use until quite recently. Hops were, and still are, grown under a wide range of cultural and geographical conditions throughout middle and southern Europe, from Russia to Ireland. It should not be surprising, therefore, that various support systems developed until it is recalled that they all have the same objective.

Prior to 1956, hop gardens wherever located were visible as forests of poles, more or less covered by foliage according to the season. In many areas, the poles were secured to ungalvanized, solid, iron rod of some five-sixteenths of an inch diameter and plenty of evidence of this is still to be seen. In Yugoslavia, where atmospheric pollution is low and corrosion consequently slow, growers still use stout rod or wire rather than afford the relative luxury of galvanized material, zinc being an expensive import. The use of galvanized strand, first reported in Germany in the 1890s, appears to be more common in western Europe where industrialization and humidity result in an increasingly corrosive atmosphere.

Today, most English hop growers, whose gardens are between thirteen and sixteen feet high, think of Continental wirework in terms of small gardens of extreme height. This is true of many gardens in Germany, where there are more than one thousand gardens of less than one and a third acres each in the Hallertau region of Bavaria, but there are several areas in other countries in which quite large blocks of modern wirework, nineteen feet high, are to be found.

Locally-grown softwood is the timber traditionally used in European hop gardens. However, Spanish growers use elm and chestnut for the construction of small areas and pine for larger areas of modern design. The treatment of timber to delay fungal attack has so far been partial and of very limited value. As in England, some growers consider that charring the base of the pole arrests decay but various chemical preservatives are recommended with such frequency that it seems there has been a fairly widespread use of them. Unfortunately, little published data comparing the effect of wood preservatives on pole life are available. It may be assumed that no significant advantage has resulted except from steeping the butts in very hot creosote.

Since 1956, there has been a steady effort, which was generated in eastern Europe, to improve wirework structures. There the state-controlled headquarters of the hop industry in these countries were seeking either to reduce imports of hops from such traditional sources as Germany and Czechoslovakia, or to revitalize their past export trade in the commodity. In both circumstances, there existed the spur to look critically at all hop growing techniques.

The Hungarians made public their efforts in the wirework field in a paper given by Pasztor at the 12th European Hop Growers' Congress in Warsaw in 1962. The essentials of the new system described were concrete poles spaced seventy-two feet apart in each direction. This change was made to economize in the use of timber and labour and to achieve space for greater mechanization, whilst still providing safe support for the growing crop. The reappraisal had not included all details, however, and the traditional fastenings used proved not to be strong enough.

In 1959, a rapidly expanding Bulgarian hop industry, again short of timber because of competitive demands from the building and chemical industries, produced a wirework structure of modern design. This was well planned for the situation and included the use of pre-stressed concrete poles spaced eighty-two feet apart in each direction. The number of poles per acre varied with the size and topography of the garden and reached the low figure of eight in suitable situations. The wirework, of high tensile steel, was twenty-four feet in height. An interesting feature of the construction was the provision of diagonal supporting wires, linking the tops of all poles, for added security. It was claimed that this design had a construction labour requirement of twenty-five man-days per acre when teams trained in erection technique were employed. There were reports of complete gardens of 100—125 acres in extent and some 2,000 acres were erected in the space of three years using this design. This wirework aroused the interest of a number of English hop growers who discussed, with the designer, the introduction of the design into this country. However, the cost of materials and the fear that the design, although excellent for Bulgarian conditions, might have proved inadequate for appreciably heavier crop loads discouraged further action.

In Yugoslavia, research workers were not slow to follow the success of their neighbours. By 1964, a number of concrete pole structures had been erected and these appeared to be both satisfactory and economic. The poles were placed much closer together than in the designs described above, being fifty-five feet by thirty-three feet apart. The inside poles were twenty feet high, of pre-stressed construction, and weighed up to three hundredweights each. All the wire in evidence at that date was ungalvanized steel rod. It was considered that the maximum safe area for a single construction was twenty acres. A recent visit showed that there are now some hundreds of acres of this design in use.

Also in 1964, a German grower and two industrial companies combined to produce another design for wirework incorporating well-spaced concrete poles and high tensile wire. This was excellent but very expensive in both material and labour cost, due largely to the need to conform to local building regulations. Three more schemes followed, one with concrete poles and two with steel poles. Two of these new schemes were constructed on the same farm and compared thoroughly. The cost of the concrete pole construction was double that of the steel pole construction; the latter, costing £440 per acre, was little dearer than traditional wirework and was considered to be safer. The subsequent partial collapse of a steel pole construction made this doubtful.

For a number of years, some German structures of basically traditional design had included double bearing wires, one being positioned directly below the other to which it was joined at the centre of the span. This practice was employed to greater effect, by increasing the sag of the upper wire, in the new designs of German origin. The idea was carried further by a M.

Gerber, a French agricultural engineer, who compared the bearing wire spans to electric railway overhead conductor spans and to suspension bridge spans. He realized that a sagged wire is capable of supporting much greater vertical loads than the same wire when stretched taut. In his design for hop wirework, the transverse top, or carrying, wires were supported by droppers attached to the sagged bearing wires. The droppers enabled the top wires to be suspended at a uniform height above ground level. The lateral movement of the droppers was prevented by attaching them to light horizontal wire running beneath the bearing wire and passing from pole to pole. The poles were fully preserved softwood and of generous size and spacing. The wirework was assembled on the ground and the poles pulled into a vertical position by tractors. This sounds a formidable task but it should be borne in mind that many of the gardens are only about two acres in extent.

A low-pole density garden, designed co-operatively by Dr. Maton, Director of the Belgian National Institute of Agricultural Engineering, and Mr. Thomas, of Trefilieries Leon Bakaert, was erected in Flanders in 1967. This five-acre construction has a conventional wire suspension and some sixteen very stout poles per acre. The anchors are all of the helicoid plate type (screw anchors) buried six feet deep and the poles, standing twenty feet high, are pressure-creosoted pine. The designers have used multistrand high tensile cables of great flexibility. This undoubtedly made the construction of joins and terminations much easier but raised the cost of wire to some two and a half times that of the seven-strand high tensile wire used in this country. The top wire is protected not only by galvanizing but also by a 1 mm thick covering of light-fast P.V.C. This wirework is believed to be the first construction of its type to be fitted with equipment to measure and record the tensions of the major wire components and the wind force and direction during the growing season. High wind speeds are expected in the rather exposed situation, only twenty miles from the Belgian coast, and the results of the load measurement should prove most instructive over the course of some years.

It will be evident that the conflict between long-term investment and profitability in hop growing continues unabated. There is no other difficulty in the way of finding a mechanically safe means of supporting the growing crop. It may be that the greatest future hazard to the hop growing industry is the relatively new one of the pre-brewing processing, or even the synthetic substitution, of hop resins. Many growers in this country are very conscious that the surest way of continuing the production of this highly regarded and valuable crop is to meet this and other challenges by keeping production costs to the minimum. Undoubtedly, trials and experiments in wirework will continue to this end both on the Continent and at home. This is evidenced by the erection of a new garden, of low-pole density design, in East Kent in which the automatic recording of loads and wind conditions will take place over the next several years.

T. M. Telford

The authors discuss development of the livestock rearing system practised at Cae'r Hafod Isa and relating it to the changes that have occurred in the Denbighshire upland.

Livestock Rearing in Denbighshire

W. D. Griffiths

CAE'R HAFOD ISA is a modern livestock rearing farm of 222 acres of enclosed land situated on the edge of the Clocaenog Forest about five miles from Ruthin which is the administrative centre of Denbighshire. In an exposed position at a height of around 1,000 ft and with a rainfall of 45–50 in. the farm offers superb views of the town lying in the lovely Vale of Clwyd, the nearby Clwdian Range and of the surrounding upland. About one mile away is the Pincyn Llys memorial at 1,354 ft which is visible for many miles and was erected in 1830 by William, second Lord Bagot, to commemorate the completion of the large mountain plantations in the vicinity. These plantations were felled during and after World War I, but the Forestry Commision began to plant the Clocaenog Forest in 1930; it now comprises some 15,000 acres and is the second largest forest in North Wales. The development of the livestock rearing system now practised at Cae'r Hafod Isa illustrates the changes that have occurred in recent years in the Denbighshire upland. Many farms have ceased milk production and have amalgamated with adjoining farms. Meanwhile programmes of land improvement by removal of hedges and banks, ploughing, reseeding and the application of lime and fertilizers have gone hand in hand with the provision of modern buildings and fixed equipment to cater for increased livestock numbers and improved performance.

Before 1941 Cae'r Hafod Isa was approximately 40 acres in extent with mountain grazing in addition. The buildings at that time comprised single rank shippons for fifteen cows, a feed barn and loose boxes. In 1941 Cerrig-Oerion, a sheep farm of about 100 acres (plus mountain grazing) about 1½ miles away, was rented. The mountain grazing of both farms was taken over

by the Forestry Commission in 1950, but in 1960 Cerrig-Oerion was purchased. For many years the farming policy was based on a dairy herd of about seventeen cows, plus followers, and 200 Welsh Mountain ewes crossed with Suffolk rams for fat lamb production. The present owner-occupier, Mr. J. H. Jones, took over from his father in 1952 and after a few years decided to seek an alternative to milk production. Labour was difficult (the farm is isolated and difficult to get to in bad weather) and the layout of the fields is poor for a dairy herd. In 1957 the decision was taken to run down the dairy herd and commence building up a herd of single suckling cows. The purchase of a neighbouring 82 acre holding (Tre'r Parc) in 1961 has helped the build-up of a viable livestock rearing system.

Beef suckling herd

Most of the single suckling cows are Welsh Black and they are crossed with a Hereford bull, the objective being the production of white-faced calves for the autumn sales. In the early years, calving the cows between February and May seemed to be sound policy, as there was a reasonable demand in the following October for the fairly small type of calf. With the herd calving at this time of year most of the calvings can be outside and buildings are of minor importance. Over the past few years, however, it has become increasingly clear that the demand is for a heavier calf and Mr. Jones has been successful in gradually advancing calving with the aim of confining it to the period October to January. This policy has, undoubtedly, produced much heavier calves and has had a considerable effect on the economy of the farm. In 1969 with fifty-two cows on the farm thirty-eight calved by 5th November.

The key factors for success with this system are output per cow, stocking rate, and low supplementary food costs. The aim at the farm is to produce a calf weighing over 5½ cwt by October, at as low a cost as possible. The calves are creep fed during the winter and turned out to grass with their dams in early spring. At weaning in July they are turned on to clean pasture and fed about 2 lb per day of concentrates up to selling time. Under this system the calves make a daily liveweight gain of about 2·2 lb and the cows calve down again in good condition. Mr Jones is now using his own weighing machine which is of great value not only for weighing the calves, but to allow selection of the cows with the best mothering qualities. The final average weight of the calves just before selling in 1969 was:

28 steers—659 lb
17 heifers—602 lb

New buildings

After accepting that a change in calving policy was desirable, the provision of good buildings was considered carefully. The old buildings at Cae'r Hafod Isa and the other two farms were quite inadequate. Gradually, over the past nine years, an excellent layout for fifty–fifty-five suckling cows and their calves has been provided at Cae'r Hafod Isa. Optimum use has been made of the 50 per cent grant available under the Hill Farming and Livestock Rearing Acts 1946–59. For storage of hay and straw a new six-bay Dutch barn was provided in 1960 and a six-bay lean-to was added, making use of material from the old barn and also from a barn at Tre'r Parc. It was then decided to provide loose housing accommodation for the cattle and by

House and buildings at Cae'r Hafod Isa

October 1966 the first part of this work was completed. A steel and corrugated asbestos, portal framed covered yard 60 x 54 ft was erected. This provides a feeding arrangement and lying area for the cows, together with a creep for the calves, giving them access to an adjacent shippon. These buildings, together with the existing buildings described, would have been adequate for about forty-five cows and their calves. It was clear, however, that additional accommodation would be worth while. Firstly, to allow for herd expansion; and secondly, to permit the fattening of calves which do not sell well in the autumn sales, thereby greatly strengthening the farmer's bargaining position. The covered yard accommodation was extended in 1969 by the addition of a further covered yard 75 x 40 ft. This building provides lying accommodition in sections for the cows or fattening cattle with a feeding arrangement along one side. Total cost of the covered yard accommodation including improvements to the access road and the provision of a dungstead was £6,300 gross, £3,150 net after deduction of 50 per cent grant.

Ewe flock

Sheep play an important part in the economy of these upland farms; they can be complementary or alternative to the suckling herd. Where both enterprises are kept, the balance between the two must be correct if optimum results are to be achieved.

At Cae'r Hafod Isa there is a flock of 420 ewes, consisting of 380 Welsh Mountain and forty Welsh Half-bred ewes. The Welsh ewes are crossed with Border Leicester rams for the production of Half-bred ewe lambs and fat lamb production. The Half-bred ewes are crossed with a Suffolk ram and all the lambs are sold fat. Of the 120 ewe lambs selected, 112 are sold at the special Half-bred sales; about eight are retained every year to maintain the Half-bred flock. About 150 Welsh ewes are purchased direct from hill farms each year and do well under upland conditions. They are retained for two seasons, or three if found to be sound in the mouth. The lambing percentage is about 105 (lambs weaned per 100 ewes tupped). Lambs are sold fat from July onwards and those not sold by the end of September are finished on rape. They are graded at about 36 lb and in 1969 averaged £6 10*s*.

The ewes are fed from the turn of the year on a ration consisting mainly of sugar beet pulp, commencing at the rate of 4 oz per day, increasing to 8 oz at time of lambing. Feeding continues until there is sufficient grass and the total feed costs works out at under 10*s*. per head. From March onwards the ewes and lambs are fed swedes which have been grown successfully for some years.

Financial results

Gross margins for the year ending 31st October, 1968

	£
Cattle (45 cows)	
Gross output*	4,051
Variable costs† (forage excluded)	621
Gross margin	3,430
Gross margin per cow	76·2
Sheep (400 ewes)	
Gross output	2,642
Variable costs† (forage excluded)	210
Gross margin	2,432
Gross margin per ewe	6·08
Total gross margins (sheep and cattle)	5,862
Forage costs (fertilizers, seeds, etc.)	629
Total gross margins (forage costs deducted)	5,233
Forage acreage (cereals deducted) —215	
Gross margin per forage acre	24·3

*Includes 17 cattle sold fat.
†Variable costs consist of concentrates (including home-grown), veterinary, shearing and casual labour.

Fixed costs

With a gross margin of about £24 per acre, it is important that the fixed costs be kept as low as possible. There is no rent as such and a considerable part of the acreage was bought cheaply. Apart from a small amount of casual help the labour force consists of Mr. Jones and his son, David (age 19). There is also a pig enterprise of about twelve sows selling weaners. With a long winter and a large hay requirement the farm is well equipped with the necessary machinery for a grassland system.

There is little doubt of the worthwhileness of the new buildings. With heavier stockings and improved performance of the suckler herd, total gross margins have risen from £4,260 in 1966 to £5,233 in 1968. Apart from this, the buildings have simplified management and kept the cattle off the land during the winter when severe poaching can occur.

The future

Although financial results are good at present, rising costs are a cause of concern and the success of the system is largely based on hill farming subsidies. In 1967–68 hill cow, hill sheep and calf subsidies amounted to no less than £1,714. Without them, at present price levels, upland livestock rearing systems would be uneconomic.

This article has been contributed by **T. M. Telford, B.Sc.(Hons.), Dip.Agric.(Cantab.),** Senior District Agricultural Adviser, and **W. D. Griffiths,** County Livestock Husbandry Adviser, both with the N.A.A.S. at Ruthin, Denbighshire.

32. Mid-Northamptonshire

W. J. Dalton

MID-NORTHAMPTONSHIRE is a district of about 120,000 acres stretching from Market Harborough and the Welland Valley forming the boundary with Leicestershire in the north, to the borders of Bedfordshire and Buckinghamshire in the south.

Pleasant, gently undulating countryside once largely associated with livestock grazing and hunting, but now approximately half of it carrying arable crops.

Indeed, some traditional cattle fattening on the first-class pastures round Market Harborough is still carried on. The grassland here is capable of giving high liveweight gains with little fertilizer except basic slag and lime to maintain a high content of white clover. The success of the men in this area is due as much to their skill in buying store cattle as in the art of managing their grassland. Of recent years, however, new generations have moved in and, with the plough, have brought a gradual change with larger acreages of cereals, beans, etc.

This increase in the arable acreage is a prominent feature of the whole of Mid-Northamptonshire. The soil is derived mainly from the Lias and boulder clays, and the Northamptonshire sand and ironstone. It is good soil, capable of growing a wide range of agricultural crops. The farms are of moderate size with at least two-thirds of the land in farms of 200 acres and over. With this flexibility the choice of cropping and stocking is often more a result of the occupiers interests and preferences than the dictates of soil and climate.

So one finds both dairying and meat production on adjoining farms. Crops include potatoes and sugar beet, herbage seeds, oilseed rape, peas as well as the usual cereals and beans; all doing well in the hands of the enthusiast. Northamptonshire is not regarded as one of the main milk producing counties, but dairy farms are scattered fairly evenly throughout the district and it is the dairy farmers who have led the way in intensive grassland farming.

Milk is produced from both highly productive leys and permanent pasture, with paddock and strip grazing and silage-making now well proven aids to good grassland management.

In spite of the relatively low rainfall—23–24 in. per annum a stocking rate of $1\frac{1}{4}$–$1\frac{1}{2}$ acres per cow equivalent is achieved by many.

High nitrogen usage, controlled grazing and self-feed silage are now being used increasingly for store and fattening cattle. There is renewed interest in the possibilities of grassland because although there are several very successful 'all arable' farms, the majority feel that livestock and leys are still the key to maintenance of fertility and workability on the medium and heavy soils of the area. Long runs of arable, especially of cereals, appear to have caused loss of soil structure so that they are particularly liable to suffer from compaction and poor drainage in very wet seasons. The intensive cereal cropping has also contributed to the spread of the wild oat so that it is now by far the most troublesome arable land weed.

Sheep numbers have tended to decline in recent years but are still a significant enterprise. One can find few if any cases where the very high stocking rates associated with work at research establishments have been maintained because, in practice, heavy sheep stocking has led to a decline in thriftiness. However, the use of clean short leys, proper dosing, the housing of ewes in winter and so on could renew interest in the sheep as a profitable grazing animal. Several farms with no breeding flock make quite a useful additional income by buying store lambs in the fall and fattening them on stubble, beet tops, surplus autumn grazing etc., or even on specially sown crops such as kale.

Kettering with its long history as a centre of the Northamptonshire boot and shoe industry is the principle town of the district. No one who has been in the vicinity of Kettering can have failed to notice the giant excavators and earth heaps of the opencast iron ore mining activities. Temporarily it makes a horrible scar on the landscape and presents difficulties for the farming occupiers. Fortunately, legislation has brought about the restoration to agricultural land of workings both old and new, and it is one of the co-operative tasks of the local N.A.A.S. and A.L.S. to aid the restoration, with advice and financial help from an Ironstone Restoration Fund set up by Act of Parliament. There are now several thousand acres of this man-changed landscape in agricultural use.

Unfortunately, the district is not to be spared loss to urban advancement. The town of Wellingborough at the southern end is to be substantially enlarged to take London overspill and is expected to grow from its present population of about 30,000 to 86,000 by 1981 and, of course, will swallow up several hundred acres of good farmland.

Should the short-listed site at Thurleigh be selected for the third London airport, part of the district could be influenced by housing requirements and so on for some of the 45,000 persons likely to be employed there.

Dairy Concentrates—

Where to store them

C. C. Grant *Agricultural Land Service, Worcester*

A GREAT deal has been written and said over the years about the various types of milking parlour. Indeed, there has been a distinct element of 'keeping up with the Jones's' in having the currently popular model. However, comparatively little has been written or said about the storage of concentrates to be fed in these parlours. Whether an abreast, tandem, chute or herringbone type of parlour is chosen, the cows will most probably still have to be fed on concentrates in the parlour. Rising labour costs and the availability of discounts for bulk delivery of feedingstuffs both encourage a change from sack storage and the job of tipping the contents into small hoppers about six feet above floor level, to bulk storage and gravitational or mechanical handling. Plainly, bulk storage demands storage space either above the parlour or reasonably close beside it.

Types of store

There are four alternative types of store in use today which can be used with all types of parlour. There is the flat loft, the hoppered loft and either a bulk hopper or a ground level foodstore linked to an auger or conveyor system.

Flat loft. The floor is comparatively simple in construction but needs a building of adequate height and a structure with sufficient strength to carry the loading. Probably its main disadvantage as a concentrate store is that it is necessary to shovel a high proportion of the concentrates to chutes leading down to the feed meters below. This in turn means frequent visits to the loft. It is also advisable to sweep the loft out before a new delivery is made to ensure that there is no cake left to become stale.

Hoppered loft. If properly designed and again of sufficient strength, a hoppered loft can eliminate all handwork. The angle of the hopper sides should ensure that the cubes or meal slide evenly down to the chutes, and there should be no flat surfaces on which feed can lodge and deteriorate. Care must also be taken to avoid dust entering the parlour.

Bulk hoppers. Free-standing bulk hoppers are elevated on legs and can be made to discharge their contents either centrally below themselves or to one side. The former type is normally used when an auger or conveyor is used to carry the food to small hoppers set over the feed meters. This system is the best if vermin are a problem on the farm.

Ground level foodstore. This type is most commonly used when the existing building is available. The main item of expenditure would then be the auger or conveyor required to convey the food around the parlour. The main disadvantage to this system is that a certain amount of shovelling is usually required even if a hopper is formed at the base of the auger.

Deciding a system

Before taking the decision as to which of these types to adopt it is wise to consider the quantity of concentrates to be stored. This will be governed by three things. Firstly, the number of cows; secondly, the feeding policy; and thirdly, the safe length of time that the concentrates can be stored. This last item can vary considerably but mainly depends on the type of food and the climatic conditions, particularly humidity. If the humidity is high and the food contains added fat then the 'shelf life' is considerably reduced. However, with an average, mainly cereal food and low humidity it may well be possible to store it for up to four months. With less favourable conditions the period may be considerably reduced and the average storage period seems to be about one month, though in bad conditions this could be reduced to about two weeks.

Again, before deciding on the system, it is worth discussing with the merchant or supplier the question of bulk delivery discounts and access to the store. It is no use providing a bulk store if the lorries carrying the concentrate cannot reach it because of too narrow or difficult an access route.

Another factor that may well affect the decision as to the type of store is the question of the availability of space. For example, if a new parlour is to be constructed in an existing building the presence or absence of an existing loft may be considered critical. If there is no loft it may be thought that rather than dismantle an existing roof, raise the walls and provide both a new loft floor and a new roof it would be more economic to provide an external bulk hopper or to utilize an existing loose box as a foodstore. If neither of these alternatives are possible then a loft may be further considered, but the suitability of the existing structure to receive the extra weight must be taken into account. If not capable of taking the added load it may be possible to support the main beams of the loft floor by stanchions set within the building for which professional advice is advisable.

Lighting and ventilation within the parlour can be assisted by the absence of a loft and if the alternative system of augers or conveyors is properly installed with good quality materials, mechanical breakdowns should be very infrequent.

Costs

Costs vary considerably but a flat loft will normally be cheaper than a hoppered one. If use can be made of existing facilities then costs can be kept down. With large parlours it may not be necessary to loft over the whole area to store the required quantity of feedingstuffs but if only part is lofted an auger system would be required for the non-lofted part. However, this would amount to having two separate systems for one parlour, so the loft may be omitted entirely in favour of a bulk store and conveyor system. With new parlours, the loft floor will usually be cheaper for smaller parlours but a store and conveyor system may well be less costly for larger ones.

Safety

One final word of warning. The danger of overloading on a loft floor, cutting through joists to give access to feed hoppers or, for that matter, cutting through truss members of the roof truss to make way for feed handling equipment cannot be over-emphasized.

The Ministry's Publications

Since the list published in the February, 1970, issue of *Agriculture* (p. 93) the following publications have been issued.

MAJOR PUBLICATIONS

OUT OF SERIES

Further review of certain Persistent Organochloride Pesticides used in Great Britain. Report by the Advisory Services Committee on Pesticides and other Toxic Chemicals. (SBN 11 270152 3) (New) 12*s*. 6*d*. (by post 13*s*. 2*d*.)

Fumigation with Ethylene Oxide, 1969. Precautionary Measures. (SBN 11 240935 0) (New) 1*s*. 9*d*. (by post 2*s*. 1*d*.)

Joint Committee on the use of Antibiotics in Animal Husbandry and Veterinary Medicine. Report by the Secretary of State for Social Services, The Secretary of State for Scotland, the Minister of Agriculture, Fisheries and Food and the Secretary of State for Wales. (Chairman: Professor M. M. Swann). 1969. (SBN 10 141900 7) (New) 8*s*. 6*d*. (by post 9*s*.)

FREE ISSUES

SHORT TERM LEAFLETS

No. 45. Carbon Dioxide Enrichment for Lettuce (Revised)
No. 67. Farm Waste Disposal (Revised)
No. 97. Weed Control in Peas (Formerly A.L. 376) (New)

UN-NUMBERED LEAFLETS

Rats and Mice. What to do about them (New)
Take Care when you Spray (Revised)

Priced publications, except where otherwise stated, are obtainable from Government Bookshops (addresses on p. 148) or through any bookseller. Single copies of the free items are obtainable from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex. HA5 2DT.

books received

A Discussion of Current Policies and the Future Structure of Agriculture. Bulletin No. 8. Copies from the Agricultural Adjustment Unit, University of Newcastle upon Tyne. 10*s*. (by post 11*s*.)

Animal Breeding Research Organisation Report. January 1970. Agricultural Research Council. H.M.S.O. 7*s*. 6*d*.

Rights of Way and Access to the Countryside. Oyez Practice Notes No. 55. J. F. Garner. Oyez Publications, 1970. 30*s*.

Agricultural Co-operation in the United Kingdom Summary of Statistics 1968-69. Plunkett Foundation, 1970. 5*s*.

Results of Pig Management Scheme 1969. Department of Land Economy, University of Cambridge, Silver Street, Cambridge. 2*s*.

The Bread Industry in the United Kingdom. A Study in Market Structure, Conduct and Performance Analysis. P. Maunder. University of Nottingham and University of Technology, Loughborough. 10*s*. 6*d*.

Yorkshire. Geography of the British Isles Series. H. Tolley and K. Orrell. Cambridge University Press, 1970. 13*s*.

in brief

- **Where there's muck**
- **Wild oats and tri-allate**
- **Mexican dwarf wheat**

Where there's muck . . .

It used to be said 'Where there's muck there's money', but in some areas and on some farms today aggregations of livestock are such that it would be truer to say where there's muck there's *worry*. With every increase in intensification, the volume of animal waste, recalling that classic confrontation of Hercules in the Augean stables, cannot be seen as just a passing phase incidental to productivity farming, but rather as an integral problem of general farm waste disposal that will become more acute as regulations governing health and amenity bite deeper. Hence Mr. C. T. Riley's forward-looking article in the winter issue of the *N.A.A.S. Quarterly Review** is one which should be widely read for its practical good sense.

Expressed as an annual total, 120 million tons of excreta from our cattle, sheep, pigs and poultry appears daunting, but if we exclude grazing animals, which make their own contribution to solving the spreading problem, it should not be beyond technological skill in processing the raw material ultimately to make its manurial value economically available away from the sources of its production, and so offset a considerable slice of the £30 million we spend a year on imported fertilizer.

The disposal of animal waste is now a matter for individual farm planning before projects are started and buildings put up—an item that should feature in the overall capital requirements of the enterprise and pay its way equally with the more obviously productive aspects of a livestock unit. 'There are indications', says Mr. Riley, 'that in future farms will fall largely into two groups—the *normal* unit and the *problem* unit. In the case of the normal unit, disposal on to land will be the prime object, and this will be achieved with better technological help. There may, however, be ten per cent of cases where specific treatments must be provided to obviate a disposal problem, and in such cases the capital commitment may be very high'.

On normal farms we may expect a need for more storage than is evident at present and it is likely to be sited above ground rather than below. Indeed, the quantity of muck that can be efficiently dealt with long term in relation to soil type and environment may well determine the number of animals that can be kept with a minimum disposal cost.

Dealing with the problem unit will, by definition, be more difficult from a costing viewpoint, looking, says Mr. Riley, to some compromise treatments emerging from industrial experience and methods of human sewage disposal. Versions of the oxidation ditch, high rate biological filtration using plastic media, and the use of flocculants are possible answers. Many factors play on the problem of muck disposal. At the moment the great majority of farms are seen to be handling it without too much difficulty, but with every increase in the scale of intensive livestock husbandry the more urgent it becomes to find a practical and economic solution to putting muck where it properly belongs.

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*Obtainable from H.M. Stationery Office (addresses on p. 148) price 3*s*. (by post 3*s*. 4*d*.).

Wild oats and tri-allate

THE trouble with wild oats is that they creep up on you. Just one or two in an otherwise clean field is the vanguard of an infestation that may take years to eliminate. Hence the 'stitch-in-time' advice to hand rogue in the early stages, taking care to pull the *whole* plant and destroy it away from the field. Where, however, recourse has to be had to soil-applied weed-killers to control wild oats in crops of wheat and barley, as well as in peas, beans and carrots, liquid tri-allate has been available for several years.

Now recent experimentation by the Weed Research Organization on its Begbroke Hill farm points to the possibilities of this chemical in *granular* form. The difficulty with liquid tri-allate is that it is volatile and must, therefore, be mixed with the soil immediately after application; distribution tends to be uneven and the results *vis à vis* control of the weed variable. Another advantage of the granular form is that, unlike the liquid, it is not limited to pre-emergence control. So far the new form of this chemical, at a rate of 1·5—2 lb per acre, has given effective control of both wild oat seedlings and the growing plant without adversely affecting wheat or barley, but before any hard-and-fast conclusions are reached, especially as regards the influence which soil and climate may exert, extensive field-scale trials, by both official bodies and commercial firms, are being carried out. It will probably be some time before granular tri-allate is available commercially, but if it passes the exhaustive tests which it is undergoing, arable farmers in the future may be saved a good deal of worry, loss of time and loss of crop.

Mexican dwarf wheats

IMPRESSED by the outstanding performance of certain Mexican dwarf wheats on Mr. Flemming Juncker's farm in the Jutland province of Denmark last year, Mr. Emrys Jones, the Ministry's Chief Agricultural Adviser, has obtained a small quantity of seed for testing on N.A.A.S. Experimental Husbandry Farms. These dwarf wheats were originally bred by Dr. Norman Borlaug, among about 400 other varieties, to raise yields in the under-developed countries. Because of their strong, short straw, their potential to accept high dressings of nitrogen without lodging (Mr. Juncker gave up to 280 units per acre) is a character which is well worth investigation under British conditions, particularly in East Anglia where climatic conditions are not dissimilar from those in Jutland. In Mr. Juncker's experience April sowings yielded two tons per acre when harvested in September, and tests have shown these wheats to have first-rate bread-making qualities. Cereal fungus diseases, in particular mildew, may have to be set on the debit side of this promising introduction under temperate conditions, but Mr. Emrys Jones is hopeful that new systemic fungicides coming on to the market could cope with that.

New pesticides for old

IN THE view of an international group of experts meeting under the auspices of FAO in Rome, there is a real danger that the world armoury of pesticides capable of controlling many important pests may be running down. It has been shown that sustained exposure of pests to any pesticide almost invariably results in the appearance of resistant strains. To minimize this danger, chemical applications should ideally be confined to precise target areas and timed to have maximum effect, so excluding unnecessarily persistent chemicals. It was also recommended that the use of pesticides should always be integrated with all other suitable methods of control to just contain pest populations below the level likely to cause economic injury.

AGRIC

Agricultural Chemicals Approval Scheme

The booklet 'Approved Products for Farmers and Growers, 1970' is now available

Copies may be obtained, free, by farmers and growers from the Ministry Divisional Office appropriate to their area.

Since the new List went to press, the following products have been approved:

NEW CHEMICALS

FENAZAFLOR

A new type of acaricide for the control of active stages and summer eggs of fruit tree red spider mite on apples.

Wettable Powders

Lovozal 40—Fisons

FENITROTHION

An organophosphorus insecticide for the control of codling, tortrix and winter moths, aphids, blossom weevil, capsids and sucker on apples, pea moth and (by making a bran bait) leatherjackets in cereals.

Liquid Formulations

Accothion—Cyanamid

Boots Fenitrothion Insecticide (not peas)—Boots

THIOMETON

A systemic organophosphorus insecticide for the control of aphids on sugar beet and potatoes.

Dusts

Chafer 'Dry Spray' Ekatin—Chafer

NEW APPROVED USES OF APPROVED CHEMICALS

CHLORBROMURON

Now approved for weed control in carrots and parsnips.

CHLORMEQUAT

Now approved for reduction of straw length in oats.

DICHLORVOS

Now approved for pre-blossom use on apples and pears (for the control of aphids, sucker, tortrix and winter moths).

DIMEXAN

Now approved for use on carrots to reduce growth and splitting.

MANCOZEB with ZINEB

Now approved for the control of tulip fire, rust of carnations and geraniums, and ray blight of chrysanthemums.

NEW PRODUCTS CONTAINING APPROVED CHEMICALS

CHLORMEQUAT

Liquid Formulations

Cycocel—BASF

METALDEHYDE

Dry Baits

R.C.R. Slug Pellets—Rodent Control

Company Information

The following firms have recently joined the Agricultural Chemicals Approval Scheme:

Rodent Control Limited,
70/78 Queens Road,
Reading, Berks.
Tel: Reading 54740

Zoan-Midox Ltd.,
Smarden, Kent
Tel: Smarden 331 and 376

Tenth List of Additions to Supplement No. 1, 'Chemicals for the Gardener'

BOOTS DRAZA SLUG KILLER—Boots
A pelleted bait, based on methiocarb, for the control of slugs, snails and leatherjackets.

CASORON GRANULAR WEEDKILLER—Zoan-Midox
Based on dichlobenil for the control of a range of annual and perennial weeds in paths, drives and established rose beds and shrubberies.

I.C.I. MOSSKILLER FOR LAWNS—Plant Protection
A granular material based on iron sulphate.

R.C.R. SLUG PELLETS—Rodent Control
Based on metaldehyde, for the control of slugs and snails.

Books

Recognition of Diseases and Pests of Farm Crops. (2nd Edition). E. Gram, P. Bovien and C. Stapel. Blandford Press, 1969. 55*s*. [£2·75].

This is a coloured picture book of pests, diseases and disorders of agricultural plants, captioned in Danish, English and Swedish. The previous version offered in England was captioned in Danish, English and French. The substitution of a second Scandinavian language makes this edition definitely less helpful.

The 112 plates include over 700 figures, mostly from coloured drawings not photographs which is, generally speaking, a strong point in its favour. Those of cereals and grasses impress by their excellence. The clover ones are adequate, the sugar beet roots and potato tubers disappointing—all through one has the impression that the artists were happier with foliage. Plate 101, 'Wart Disease of Potato', is dreadful. Most of the rest are adequate: the question arises 'adequate for what?' Coloured illustrations as an aid to recognition pose a problem. If the would-be user expects to be able to say 'If my specimen is affected by a certain disease (at an appropriate stage) it is bound to look like this figure', that is a naive and unreasonable expectation and he will soon run into trouble. If he is content to say 'My specimen looks very like this figure and much more like it than any of the others, so I can assume it is affected by the named disease', then he ought to be correct in most instances.

Virus workers are used to the notion that far too many different agencies can give rise to a similar changed appearance in the same host variety. This is less true with other kinds of disease and there are indeed, some in which what one can see of the whole plant or leaf tells more than the ordinary microscope can show. Plant pathologists will tend to criticize this book, in some instances harshly, yet they will buy it, as happened with the previous edition. This is probably the best clue to its value for other prospective purchasers.

E.R.W.

Modern Breeds of Livestock. (3rd Edition). Hilton M. Briggs. Macmillan, 1969. £6.

This impressive looking volume of 714 pages, written by a doyen of American agricultural education, led me to expect to find a mine of factual information on the performance of modern breeds of livestock in America. Instead, it was a disappointment to read descriptions which one associates with Breed Societies' literature.

The book deals with the fifty-three breeds of cattle, sheep, goats, pigs and horses found in America. Every chapter takes the same form, describing the origin of the breed, its introduction to the United States and its expansion there; it names the leading breeders, breed families and successful show animals. It goes on to describe the modern appearance and economic characteristics of the breed and closes with a breed evaluation, which is not supported by factual evidence. For example, it says that 'Jersey cows are also good feeders and make very efficient utilization of the grain and concentrates that they are fed'. Such an important evaluation deserves elaboration and substantiation.

One gets the impression that known unsatisfactory characters are glossed over e.g., prolificacy in Cheviot Sheep; the author says 'Whilst surpassed by some other breeds in prolificacy the average Cheviot flock can be expected to have a lambing percentage comparable to other breeds'.

Readers will find the author's geography occasionally inaccurate—'Oxford County is bounded on the West by the Cotswolds and on the South by Hampshire'. The style of writing is voluminous and repetitive. However, the book is very clearly printed on good quality paper and is lavishly illustrated; such American publications are a pleasure to look at.

The author says that the book is aimed at the student and prospective breeder and as such it fulfils its purpose. Additionally it will prove useful to anyone interested in a general account of livestock in America.

F.K.D.

Insecticide and Fungicide Handbook. (3rd Edition). Edited by H. Martin. Blackwell Scientific Publications, 1969. 60*s*.

This book is a guide to the pests and diseases of agricultural and horticultural crops and contains objective recommendations for pest and disease control. As in the previous edition, the first four chapters deal

with the biological and chemical backgrounds and with methods of applying pesticides safely and efficiently; the remainder of the book deals in detail with the problems of individual crops. The price has been increased from 32*s*. 6*d*. to 60*s*. but the text of the new edition has been revised, particularly the chapters on fruit and hops and on glasshouse crops. There is also a new chapter on forest trees.

Insecticide recommendations usually include all materials known to be effective against the pest concerned but, because of risks of long-term environmental pollution, the reader is urged not to use persistent organochlorine insecticides where shorter-lived materials are available. A non-technical grower would need help in converting recommendations given in active ingredients and approved common names into amounts of manufacturer's formulations sold under trade names, and he is advised on page 94, to refer to the free List of Approved Products for Farmers and Growers published by the Ministry of Agriculture, Fisheries and Food.

The book's main value is its reliable background information on pests and diseases and the correct use of pesticides in crop protection. Its second purpose, to record progress in new chemicals, is difficult to achieve in a hard-back publication. For example, the authors of individual chapters have provided much new information in their recommendations but some statements concerning the use of organochlorine insecticides already need to be modified following the publication, by a Government Committee in December, 1969, of a *Further Review of Certain Persistent Organochlorine Pesticides Used in Great Britain*. Also, rapid advances in the development of systemic fungicides seem likely to affect future recommendations for control of several plant diseases. *D.C.G.*

Covent Garden—Mud Salad Market. RONALD WEBBER. Dent and Sons, 1969. 45*s*. [£2·25].

Appropriately, the author of this book is a one time Covent Garden Market man and a horticulturist by training. The publishing house is also based in Bedford Street on the edge of Covent Garden, although the printing was undertaken at Letchworth. The book traces the history of the world famous market within the environment of the Covent Garden area over a period of some 300 years. Presenting the subject in this context enlivens the story and should ensure an appeal to a wider readership than horticulturists and farmers; the early chapters are, in fact, laced with spicey stories from somewhat licentious, if less permissive, times.

As landlords of the market for some 240 years, the story of the Russell family (first the Earls, later the Dukes of Bedford) is traced in considerable but, nonetheless, interesting detail. Naturally, with Drury Lane and Covent Garden Opera House sitting cheek by jowl with the market, the names of many famous players are also mentioned. It is common knowledge that Nell Gwynne started her career as a vendor of oranges, but it will come as a surprise to some readers to learn that Charlie Chaplin was also launched into show business as a result of lending a hand with the shelling of two tons of walnuts. For this, he received a free ticket for a local variety show and thus was set on the road to fame. Originally, the Garden was the *Convent* Garden of Westminster Abbey and the area and market appears to have acquired its present name by a spelling corruption. Founded by a cutler and a tallow chandler in 1678 the market, as might be expected of an organization based on horticulture, has just 'growed'. The author highlights the many controversies and criticisms which have attended the market throughout its existence. He seeks to record its peculiar 'culture'; he fears, probably justifiably, that much will be lost when the market moves to its new site at Nine Elms in 1972. Nonetheless, it is nice to think that the market will be moving to a site which long ago was covered with market gardens, the produce from which was sold through Covent Garden Market.

Readers should find this an absorbing book based on considerable research. For those who would delve in more detail, the ten-page bibliography provides many useful leads. The exhaustive index of ten pages and the twenty-five monochrome illustrations are also praiseworthy. *R.G.*

Land Use Capability Classification. J. S. BIBBY and D. MACKNEY. Rothamsted Experimental Station and the Macauley Institute for Soil Research. 3*s*. 6*d*. [17½p].

This is a technical monograph describing briefly the technique adopted by the Soil Surveys of England and Wales, and of Scotland, in classifying agricultural land into land use capability classes. As such, it is helpful to those who make use of the Soil Survey maps. There are seven classes and five sub-classes described, with useful illustrations. *C.R.*

The Farm and the Village. GEORGE EWART EVANS, Faber and Faber. 1969. 21*s*. [£1·05].

As a tireless researcher and skilled chronicler of the rural life and times in bygone eras of East Anglia, Mr. Evans is second to none among his contemporaries. In his latest book he has sought to guide understanding of the history of the region and the radical changes that have overtaken it by revealing the philosophies of its farming and integrated village activities.

It is a record of the rural past before mechanization in farming introduced entirely new concepts, eroded centuries-old customs and demanded new skills. From the memories of Suffolk men and women who served their time on the land when the horse was the motive power and the tools of seed-time and harvest were not greatly dissimilar from their medieval counterparts, the author has collected important first-hand evidence. So, too, the remembered skills of blacksmith, miller, millwright and tailor that gave self-reliance and self-sufficiency to isolated village communities.

Through these witnesses are recalled the poverty that sent women and children gleaning in the cornfields as soon as the 'policeman' sheaf was removed and the church bell gave the signal, or the crow-keeping and stone-picking that kept children away from school. Farmers exchanged cereal seed in the belief that the same strain of seed sown on the same type of land for two or three consecutive years was to invite a reduced yield. 'Riding the goaf' in order to pack as much unthreshed corn into the barn as possible was a boyhood memory shared by many an old farm worker and, overall, the tenets of Tusser clung to husbandry practice.

Although the avowed intention of this book is for the interest of younger readers and especially for school use, its appeal is certain to be much wider than that. The farming revolution of the past half century and the opening up of the countryside by modern methods of communication have brought such changes to the character of village work and life as the old generation could never have foreseen. The process of change will continue with further technological progress and, therefore, the book has implications for the future as well as being a commentary on the past.

S.R.O'H.

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